STANFORD UNIVERSITY LIBRARY
NOV 1929

UNIVERSITY OF PENNSYLVANIA

---

# SIGNIFICANT POST-WAR CHANGES IN THE FULL-FASHIONED HOSIERY INDUSTRY

GEORGE WILLIAM TAYLOR

A THESIS

IN ECONOMICS

PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY

PHILADELPHIA
1929

STANFORD UNIVERSITY LIBRARIES
LIBRARY

3781
P41T
UNCLASSED

INDUSTRIAL RESEARCH DEPARTMENT
WHARTON SCHOOL OF FINANCE AND COMMERCE
UNIVERSITY OF PENNSYLVANIA

# RESEARCH STUDIES
# IV

## SIGNIFICANT POST-WAR CHANGES IN THE FULL-FASHIONED HOSIERY INDUSTRY

# SIGNIFICANT POST-WAR CHANGES IN THE FULL-FASHIONED HOSIERY INDUSTRY

---

A THESIS

IN ECONOMICS

PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL OF THE UNIVERSITY OF PENNSYLVANIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

GEORGE WILLIAM TAYLOR

PHILADELPHIA
1929

Copyright, 1929,
by the
University of Pennsylvania Press

# PREFACE

To those who by kind assistance have made possible the completion of this analysis of SIGNIFICANT POST-WAR CHANGES IN THE FULL-FASHIONED HOSIERY INDUSTRY I express my sincere thanks.

Especially am I indebted to Dr. Anne Bezanson, of the University of Pennsylvania, under whose direction the study was made. Dr. Bezanson's aid and counsel have been of inestimable value in determining the procedure followed and the results achieved. To Dr. Alfred H. Williams, of the University of Pennsylvania, I owe thanks, not only for his advice on many questions arising during the course of the study, but also for arousing much of my interest in this particular field.

Those "in the trade" have been both willing and eager to assist by supplying information. The large number of full-fashioned hosiery manufacturers who so adequately furnished data by questionnaire, aided materially. Their interest in this study has been most encouraging. Officials of the Federation of Full-Fashioned Hosiery Workers were especially kind in making available much information necessary for the completion of this study.

Without the assistance of the manufacturers and importers of full-fashioned hosiery machinery, this study would have been an impossibility. Although the furnishing of the data requested entailed considerable work for each producer and importer, without exception every firm cooperated in the study. Mr. R. N. Apprich, of the Textile Machine Works at Reading, Pa., has been especially helpful in supplying data and information.

While I have been able to mention individually but a few of those who had a part in this work many others have given freely of their time and efforts. To all I express my gratitude.

GEORGE WILLIAM TAYLOR

# CONTENTS


| CHAPTER | | PAGE |
|---|---|---|
| I | Purpose and Scope of the Study | 1 |
| II | Trends in the Production of Full-Fashioned Hosiery | 9 |
| III | Evidences of Changed Management Problems | 33 |
| IV | Equipment Trends in the Full-Fashioned Hosiery Industry | 54 |
| V | The Nature of the Equipment of the Full-Fashioned Hosiery Industry | 78 |
| VI | Productivity of Different Types of Knitting Machinery | 100 |
| VII | Summary and Conclusions | 114 |
| | Appendix | |
| | Relation of Unfilled Orders and Stock on Hand to Production of Full-Fashioned Hosiery | 119 |
| | Types of Hosiery and Methods of Manufacture | 121 |
| | Bibliography | 126 |
| | Index | 129 |

Digitized by the Internet Archive
in 2025

https://archive.org/details/significantpostw0000geor

# CHARTS


| CHART | | PAGE |
|---|---|---|
| I | Indices of Monthly Production of Women's Hosiery in the United States, 1924–1928 (Base—January 1924) | 25 |
| II | Relation between Orders, Stocks and Production of Full-Fashioned Hosiery, 1924–1929, Monthly | 48 |
| III | Percentage of Yearly Production of Full-Fashioned Hosiery Knitting Machines by Sections Per Machine, 1919–1928 | 67 |
| IV | Indices of Production of Full-Fashioned Hosiery and of Machine Sections, 1924–1928 | 69 |
| V | Percentage of Yearly Production of Full-Fashioned Hosiery Knitting Machines by Gauge, 1902–1928 | 83 |
| VI | Percentage of Cumulated Production of Full-Fashioned Hosiery Knitting Machines by Gauge, 1902–1928 | 89 |
| VII | Full-Fashioned Hosiery Knitting Machines in Operation in the United States Classified by Sections Per Machine, March 1, 1929 | 94 |
| VIII | Monthly Production of Full-Fashioned Hosiery Classified by Gauge—65 Firms, 1928 | 102 |
| IX | Percentage of Total Machine Sections Classified by Output per Full-Time Section Hour | 107 |


# TABLES


| TABLE | | PAGE |
|---|---|---|
| 1 | Production of Men's Hose in the United States, 1919–1927 | 10 |
| 2 | Production of Women's Full-Fashioned Hosiery in the United States, 1919–1928 | 12 |
| 3 | Indices of Production of Major Economic Industries of the United States, 1923–1926 | 14 |
| 4 | Production of Seamless Hosiery in the United States, 1919–1928 | 15 |
| 5 | Monthly Production of Women's Full-Fashioned Hosiery in the United States, 1924–1928 | 18 |

6 Production of Women's Full-Fashioned Hosiery in the United States, 1924–1928 . . . . . 20

7 Monthly Production of Women's Seamless Hosiery in the United States, 1924–1928 . . . . . 22

8 Index of Production of Seamless Hosiery in the United States, 1924–1928 . . . . . 24

9 Material Used in Manufacturing Full-Fashioned Hosiery, 1919–1927 . . . . . 35

10 Per Capita Consumption of Women's Hosiery in the United States, 1919–1927 . . . . . 40

11 Relation of Unfilled Orders and Stock on Hand to Production of Full-Fashioned Hosiery, 1924–1928 Monthly . . . . . 44

12 Mills Manufacturing Women's Full-Fashioned Hosiery in the United States, 1919–1929 . . . . . 55

13 Mills Manufacturing Women's Full-Fashioned Hosiery in Philadelphia, 1919–1929 . . . . . 55

14 Production and Importation of Full-Fashioned Hosiery Knitting Machines in the United States, 1902–1928 . . . . . 60

15 Production and Importation of Full-Fashioned Hosiery Knitting Machine Sections in the United States, 1902–1928 . . 63

16 Yearly Output of Machines Classified by Number of Sections Per Machine, 1919–1928 . . . . . 65

17 Annual Production and Importation of Full-Fashioned Hosiery Machines Classified by Leggers and Footers, 1919–1928 . . 72

18 Production and Importation of Full-Fashioned Hosiery Knitting Machines Classified by Gauge—Absolute Numbers, 1902–1928 . . . . . 79

19 Production and Importation of Full-Fashioned Hosiery Knitting Machines Classified by Gauge—Percentages, 1902–1928 80

20 Cumulated Production and Importation of Full-Fashioned Hosiery Knitting Machines Classified by Gauge—Absolute Numbers, 1902–1928 . . . . . 84

21 Cumulated Production and Importation of Full-Fashioned Hosiery Knitting Machines Classified by Gauge—Percentages, 1902–1928 . . . . . 85

22 Full-Fashioned Hosiery Knitting Machines Operating in the United States, March 1, 1929 . . . . . 91

23 Full-Fashioned Hosiery Knitting Machines Operating in the United States Classified by Number of Sections and by Leggers and Footers, March 1, 1929 . . . . . 93

| TABLE | | PAGE |
|---|---|---|
| 24 | Full-Fashioned Hosiery Knitting Machines Operating in the United States Classified by Gauge and Number of Sections, March 1, 1929 | 96 |
| 25 | Full-Fashioned Hosiery Knitting Machines Operating in the United States—Percentages of Total, Leggers and Footers, Classified by Gauge and Number of Sections, March 1, 1929 | 97 |
| 26 | Monthly Production of Women's Full-Fashioned Hosiery by 65 Mills in 1928, Classified by Gauge | 101 |
| 27 | Productivity of Machines Per Full-Time Section Hour | 106 |
| 28 | Production of Full-Fashioned Hosiery Per Knitting Machine in 1928 | 109 |
| 29 | Disposal of Full-Fashioned Hosiery Machines Since 1920 | 111 |

# CHAPTER I

## PURPOSE AND SCOPE OF THE STUDY

In recent years, it has become increasingly plain that the normal state of American industry is one of change. Increasing mechanization, greater production, the introduction of style in many products and the consequent obsolescence of others are but a few of the recent changes that have taken place in our dynamic industrial society. However, the central problem of management remains the same. The industrial leader must be efficient, and "efficiency means getting the utmost amount of useful results out of the facilities used" [1] in production. To be actually efficient by planning on a factual basis now requires a considerable knowledge of industrial trends and changes. Individual production policies, for instance, must be planned with regard to the general market conditions. Plant expansion can be intelligently carried out only in the light of the development of the entire industry. In other words, the modern industrial leader, to be efficient, must possess and utilize a broad concept of planning.

One of the most rapidly changing industries in the United States is the full-fashioned hosiery industry. In the few years from 1919 to 1928, the yearly production of fashioned hosiery increased over 250 per cent.[2] At the same time, the kind of material used in knitting this hosiery changed completely. In 1919, cotton full-fashioned hosiery predominated; by 1928 cotton had been almost entirely displaced by silk. Moreover, between the same years, sheerness supplanted service weight as the mode; light colors replaced the darker hues in popular regard; and many novel-

[1] Clark, J. M., "Some Central Problems of Overhead Costs," *Bulletin of the Taylor Society*, February 1927, page 287.

[2] See page 12.

ties were introduced. One secures the impression that change, so true of all industries, has been a fundamental characteristic of the full-fashioned hosiery industry.

Our task in the present study will be to analyze the most significant changes that have taken place in the full-fashioned hosiery industry since the beginning of its rapid growth in 1919. It is hoped that, as a result, those "in the trade" may be provided with a factual basis for estimating the present status of the industry and for scientifically planning future policies.

The very rapidity of the growth of the full-fashioned industry suggests the necessity for such a survey. In our considerations, we must be interested in the question of whether or not the increased production has been accompanied by sound management policies. Moreover, new problems may have developed as a result of the expansion of output. For instance, any increase in seasonality of production must be considered as an undesirable trend that future management policies should attempt to eradicate. With increasing production, efficient management must accept the responsibility of keeping men and machines constantly employed. To do so may prove impossible if seasonal operation prevails. It has been said of the coal industry that "seasonal demand is responsible for 47 per cent of the idle time in the industry; also for overdevelopment." [3]

If increased production has resulted in more seasonal operation, management problems have developed concerning, at least, overhead costs and labor management. Moreover, "unsound production policies often result in overequipment. . . . A great part of the overcapacity of a plant is the result of building the plant to take care of the largest seasonal or cyclical demand that will be made upon it—the so-called peak load." [4]

[3] Wallace, L. W., "Industrial Management and the American Engineering Council," *Annals of the American Academy*, May 1925, page 129.

[4] Bye and Hewitt, *Applied Economics*, page 43.

Seasonal operation is thus closely connected with the problem of overequipment. If surplus equipment has been installed in the full-fashioned industry during recent years, we must conclude that the increase in production has led to waste due to a faulty management policy.

It is both fortunate and unfortunate, from the point of view of management, that styles change. Much of the increased production of full-fashioned hosiery has been predicated upon changes in style, but the problem of the machine no longer adapted to produce the latest style may become of importance. Especially is this true of the expensive, highly-specialized knitting machinery used in fashioning hosiery. "There appears to be no way of combating the risk due to changing styles except by keeping inventories of finished goods at a minimum." [5] One measure of management efficiency is the trend of stocks of finished goods on hand. If style is becoming more important, the manufacturer should pay increasing attention to keeping stocks at a minimum. A survey of recent changes in the full-fashioned hosiery industry should consider this question, as well as the relation of style in the finished product to the trend in types of machinery produced. The possibility of the obsolescence of older machines is strong where specialized machinery is used to produce an article of style or a novelty.

However, we must not fail to recognize the difficulty of keeping inventories low under conditions of "hand-to-mouth" or current buying. This practice has shifted the burden of taking the risk of changes in style to the manufacturer and has made it necessary for the latter to develop a large stock on hand. Nevertheless, "the progressive manufacturer, even of style goods, is overcoming this handicap and accepting current buying as a benefit to his business." [6] This hand-to-mouth buying is used by some manufacturers

[5] Jelleme, William O., "Hand to Mouth Buying," *Bulletin of the Taylor Society*, February 1927, page 296.

[6] Thompson, Sanford E., Discussion on previous article, *Bulletin of the Taylor Society*, February 1927, page 301.

as a "steadying influence in their production and planning departments . . . if assisted by in-stock departments." [7] Thus an increased stock of goods on hand should, if good management has prevailed, be accompanied by an evenness of production. If a different situation has occurred, management policies should be introduced to reduce seasonal production.

Accordingly, the present survey aims to analyze the nature and consequences of the increased production of full-fashioned hosiery from 1919 to 1928. If seasonality and surplus equipment have developed simultaneously with production, the need for adjustment in these respects must be considered by the management. Other problems will be recognized in the survey. That the increased development of the industry has brought problems with it was indicated in a recent pamphlet by a former president of the Federation of Full-Fashioned Hosiery Workers. He wrote, "There have been already, many exceedingly ominous signs that even the full-fashioned manufacturers have overreached themselves in their efforts to meet . . . a greatly increasing demand for fine hosiery of the type which can only be made on full-fashioned machines." [8]

From a social point of view, increased production is desirable. Through it, material progress arises. However, to insure sound, efficient growth, management must recognize the problems created through the increase of production. We will, therefore, in this study, emphasize those changes that have occurred and that seem to necessitate changed management policies in the industry.

In the study of the changes in the full-fashioned hosiery industry, we will consider the following specific matters:

1. The extent of the increased yearly production of women's full-fashioned hosiery in the United States from 1919 to 1928.

[7] *Loc. cit.*

[8] Geiges, Gustave, *Overdevelopment in the Textile Industries*, page 3. Philadelphia 1928.

2. The question of whether or not this increase in production has been marked by an increase in seasonal operation.

3. The trends in unfilled orders and stock on hand in the industry, with emphasis on the changes in management made necessary by these trends.

4. The conditions responsible for the increased production of full-fashioned hosiery.

5. The estimated possibility of absorbing future increases in the production of full-fashioned hosiery.

6. The expansion of mill and machinery equipment in its relation to increases in hosiery production. Efficient equipment expansion is of primary importance; the absence of idle capacity depends upon it.

7. Changes in the type of knitting machine produced, as well as the influence of style changes upon the type of machine desired by hosiery manufacturers.

8. The value in production of the older knitting machinery no longer adapted to newer style demands.

These trends and questions will be considered because we feel that, through their study, the most important changes in the full-fashioned hosiery industry may be understood.

## Definition of the Full-Fashioned Hosiery Industry

The full-fashioned hosiery industry consists of those mills, with their organizations, that knit, loop, seam and finish stockings fashioned to the shape of the leg. Many of these mills have their own silk-throwing equipment, while many more have winding and other preparatory departments. Sericulture is a vital part of the full-fashioned hosiery industry. However, for present purposes, we will understand this industry as being concerned mainly with the knitting of full-fashioned hosiery. We have chosen to emphasize the knitting process because it is the most exacting in the industry and because the equipment used in knitting is both specialized and expensive. When erected, it can be used only for the manufacture of hosiery, and often for

a very particular type of full-fashioned hosiery. Problems of adjustment arising through changes in the industry would naturally center about the knitting process. We shall not deal with the adjustment problems of the winding, looping, or seaming departments, nor with those connected with the finishing of hosiery. Equipment used in these processes does not represent a large capital investment compared to that represented by knitting machinery, and at least some of this auxiliary equipment is usable for purposes other than aiding in the production of hosiery. We do intend, however, to include the building of the knitting machine as an integral part of the full-fashioned hosiery industry. The type of knitting machine produced and the rate of production of machines cannot fail to have an important bearing upon the adjustment problems of the industry.

The industry so conceived is of importance from another point of view. The knitting of hosiery is localized very largely in Pennsylvania and particularly in Philadelphia. A recent study in this field [9] estimated that 40 per cent of the machinery of the entire industry is operated in Philadelphia and about 25 per cent in the Reading area. There is evidence, however, that the production of full-fashioned hosiery is becoming increasingly a southern industry.[10] Particularly has there been a growth of equipment and production in North Carolina. Facts pertaining to shifts in localization are of importance to the entire trade.

The domestic production of full-fashioned hosiery knitting machinery is also localized in Pennsylvania, the only two producers in the United States having plants at Norristown and Reading.

## Point of View

The rapidity of the changes within the full-fashioned industry in recent years makes pertinent a survey of their nature and import. Those in the trade must first recognize

[9] Federal Council of Churches of Christ in America, *Industrial Relations in a Hosiery Mill*, page 7.

[10] See page 55.

actually existing conditions and trends if they would plan for the future. In order to provide such a survey to those in the industry, this study has been made from the point of view of a consultant investigating the industry for the different branches of the trade. "We now find that the line of separation cannot be drawn between any group or groups either interested in or connected with the producing forces of industry. There is no point which can be definitely fixed where the interest of one group begins or ends. The interests of all are so inextricably woven together as to preclude a diversion of effort or objective . . . nor is any one group immune from the evil consequences of uneconomic industrial operation."[11]

As a consultant for the industry in general, we have to recognize that at least three groups will be interested in our procedure and results. Certainly, the manufacturer of hosiery is vitally concerned with the total production of hosiery and the extent of its correlation to demand. He must also be interested in knowing whether or not the machinery he owns will continue to be of real worth or if the demand for its product is likely to decrease as a result of too much production or because of style changes. His profits will be affected by these matters.

The trends of the industry, particularly those relating to developments in equipment, are of importance to the manufacturer of full-fashioned hosiery machinery. A constant market for his product requires an orderly growth of production attuned to the demand for hosiery. His interest must necessarily be vital in the question of replacements of machinery now in use by newer or more desirable types—a possibility if increased production has been influenced by style trends.

The third group interested in the results of a consultant's study is the knitters in general and the union officials in particular. To this group, regularity of employment is

[11] Green, William, "Labor's Interest in Industrial Waste Elimination," *Bulletin of the Taylor Society*, June 1927, page 407.

fundamental. Moreover, we are now beginning to recognize that the objectives of the labor group are conditioned upon sound, efficient policies of management. The interest of labor in the larger question of general industrial development was voiced by Gustave Geiges, ex-president of the hosiery workers' union, as follows: "The demand for the product [full-fashioned hosiery] can be expected to increase indefinitely. The one danger we must guard against is too rapid installation of new equipment and tardiness in abandoning old machinery and methods." [12]

The manufacturer of hosiery, the manufacturer of machinery, and the labor group are interested in securing an orderly growth of the full-fashioned hosiery industry. Changes requiring adjustment in policies present problems for each group. A consultant, therefore, should recognize this community of interest in analyzing trends in the industry.

This study, therefore, has been undertaken from the point of view of a consultant who is making a survey of significant changes in the full-fashioned hosiery industry since 1919. We will emphasize those changes that appear to require recognition in changed management policies if the industry is to produce efficiently. And "efficiency means getting the utmost amount of useful results out of the facilities used in production." This definition suggests that costs of production and perhaps profits should be used as a measure of efficiency. As tools of measurement, costs or profits are not available. Moreover, they would be difficult to use in studying an industry that produces a non-standard product under varying conditions and that lacks all semblance of uniform accounting methods. Our purpose is to test management efficiency indirectly through the changes concerning seasonality of operation, unfilled orders, methods of expansion and like measures.

[12] *Op. cit.*

# CHAPTER II

## TRENDS IN THE PRODUCTION OF FULL-FASHIONED HOSIERY

Since 1919, the full-fashioned hosiery industry has increased its yearly output so rapidly that it was, in 1928, over 250 per cent greater than in 1919. While it is true that fashioned hosiery was made in the United States as early as colonial times,[1] and while the period from 1912 to 1918 witnessed, as is evident from the machinery built during those years, an increasing use of this product, it was not until about 1919 that the spectacular growth of the industry began.[2]

In 1919 the directory of the knitting trade [3] reported 92 mills that manufactured women's full-fashioned hosiery in the United States; in 1928 the same publication listed 235 mills. A production of 6,323,934 dozen pairs of women's full-fashioned hosiery was accounted for in the 1919 *Census of Manufactures,* while the census of 1927 reported 19,771,030 dozen pairs. In 1928, the Department of Commerce, reporting the production [4] of establishments responsible for over 60 per cent [5] of the 1925 census total, issued figures showing a production of 17,803,617 dozen pairs from these firms alone.

[1] Kier, Malcolm, *Manufacturing Industries in America,* pages 56, 156, 346, 370, 385.

Since the circular machine was not invented until the early part of the 19th century, the early industry was confined to full-fashioned hosiery.

[2] See page 60.

[3] Davison Publishing Co.—Davison's Knit Goods Trade—Yearly—New York.

[4] Department of Commerce, Report of Hosiery Production, Orders and Stocks of Hosiery, Washington, D. C.

Available each month since February 1923.

[5] The number of reporting firms varied monthly. Those reporting were responsible for from 63.7 to 66.1 per cent of the production listed in the 1925 *Census of Manufactures.*

The extent of this increase in production attracts the attention, not only of those connected with the trade, but also of the student of industry who sees in the full-fashioned hosiery industry an opportunity of studying the problems that coincide with industrial growth.

It will be our purpose in this chapter to study the extent of the yearly growth of the production of women's full-fashioned hosiery, comparing its increase with the yearly production of other industries, especially with that of the seamless hosiery industry.

It is significant that, while the annual production of women's full-fashioned hosiery has increased yearly, the output of men's fashioned hosiery has not. In the men's field, seamless hose has annually contributed over 95 per cent of the total production, leaving but a small percentage for full-fashioned. The importance of these two types of product in the total production of men's hose can best be seen by a study of Table 1.

TABLE 1

PRODUCTION OF MEN'S HOSE IN THE UNITED STATES.[6]

1919 to 1927

| Year | Dozen Pairs | | | Percentage of Yearly Production | |
|---|---|---|---|---|---|
| | Total | Full-Fashioned | Seamless | Full-Fashioned | Seamless |
| 1919.... | 33,220,417 | 1,242,807 | 31,977,610 | 3.7 | 96.3 |
| 1921.... | 28,160,356 | 774,650 | 27,385,706 | 2.8 | 97.2 |
| 1923.... | 37,817,538 | 1,412,871 | 36,404,667 | 3.7 | 96.3 |
| 1925.... | 40,180,022 | 1,608,754 | 38,571,268 | 4.0 | 96.0 |
| 1927.... | 44,260,577 | 1,243,935 | 43,016,642 | 2.9 | 97.1 |

Since the Census Bureau, previous to 1919, did not differentiate in its production figures between full-fashioned and seamless stockings, we must now, as in later comparisons, begin our study with 1919. This year is the earliest in which we are now interested.

[6] Department of Commerce, Biennial Census of Manufactures for "Knit Goods" for years indicated. Washington, D. C. 1927 data—Preliminary Report of Census of Manufactures, 1927 on Hosiery. Issued Feb. 21, 1929.

Table 1 shows very clearly that the yearly production of men's full-fashioned hose has hardly increased at all in the years reported, and moreover, that it supplied an almost negligible percentage of the total production of men's hose in 1927. While complete data covering 1928 production are not available, monthly reports of the Department of Commerce, from firms manufacturing from 63.7 to 66.1 per cent of the 1925 census output, indicate that no important change in the relative proportion of the production of men's full-fashioned and seamless hose occurred in 1928. In that year, of a reported production of 20,593,422 dozen pairs of men's hose, but 2.5 per cent were full-fashioned, the remainder of 97.5 per cent being seamless.

Numerous explanations have been advanced to account for this slight importance of men's full-fashioned hose as contrasted with the popularity of fashioned hosiery for women. It is said that men will not endure the discomfort of the seam in the full-fashioned foot. Women are more ready to sacrifice comfort for the sake of a better-fitting product, it is thought. Moreover, hosiery plays such an important part in women's style ensemble that style, and especially fit, become more important than in men's hose.

It seems clear that, in our consideration of the growth of the full-fashioned hosiery industry, we need not be particularly concerned with the men's product. Our study will be limited to women's full-fashioned hosiery. When we speak later of the equipment of the full-fashioned hosiery industry, our data will include that used in manufacturing both women's and men's stockings, for, with some adjustments, both products are made on the same machine. In 1927, of a total production of 21,070,445 dozen pairs of full-fashioned hose and hosiery reported by the *Census of Manufacturers*,[7] 1,243,935 dozen pairs or 5.9 per cent of the total were men's hose. However, since the knitting of a pair of men's hose consumes less than one-half the time required in knitting women's hosiery, we may assume that

[7] *Biennial Census of Manufactures*—Hosiery—Preliminary Report—1927.

less than 3 per cent of all full-fashioned hosiery machines make men's hose. And, as there is no trend toward increasing or decreasing production of full-fashioned half-hose, we may safely disregard the men's field in this study. We will assume that all knitting machines in operation are used to manufacture women's full-fashioned hosiery. This assumption is substantially correct.

It is in the yearly production of women's full-fashioned hosiery that rapid expansion has occurred, to some extent at the expense of the women's seamless product. Table 2 shows the rapidity of the growth of the annual output of full-fashioned hosiery.

TABLE 2

PRODUCTION OF WOMEN'S FULL-FASHIONED HOSIERY IN THE UNITED STATES[8]

1919 to 1928

| Year | Dozen Pairs | Relative Dozen Pairs | Value | Relative Values | Average Value 1 Dozen Pairs |
|---|---|---|---|---|---|
| 1919.... | 6,323,934 | 100.0 | $ 56,458,008 | 100.0 | $ 8.93 |
| 1921.... | 7,589,913 | 120.0 | 89,065,011 | 157.7 | 11.73 |
| 1923.... | 9,817,996 | 155.2 | 121,603,052 | 215.3 | 12.39 |
| 1925.... | 12,291,219 | 194.3 | 140,596,267 | 249.0 | 11.43 |
| 1927.... | 19,771,030 | 312.6 | 227,414,977 | 402.8 | 11.50 |
| 1928[9] | 22,254,520 | 352.8 | | | |

Table 2 shows in detail the extent of the increase in the production of dozen pairs of women's full-fashioned hosiery, and their value. With the production of 1919 as a base, the relative production for each year has been computed. It can readily be seen that the yearly production of women's full-fashioned hosiery just about doubled from 1919 to 1925, and more than trebled in 1927 over 1919. Indications at hand point to a continued increase in 1928.

[8] *Biennial Census of Manufactures* for the years indicated.

[9] Computed from monthly reports of the Department of Commerce. This estimated figure for 1928 production has been checked in another manner. Table 6 on page 20 has shown by a study of the monthly reports that 1928 production increased 14.9 per cent over 1927. If the actual census production of 1927 were increased by 14.9 per cent, the 1928 production would be 22,716,913. It appears that the figure for 1928 production in Table 2 is a very conservative estimate.

Monthly reports issued by the Department of Commerce have shown, for 1928, a production of 17,803,617 dozen pairs by firms that produced over 60 per cent of the 1925 output. Considering this reported production as being as much as 80 per cent of the 1928 production,[10] we have computed a production of 22,254,520 dozen pairs of women's full-fashioned hosiery as the output of 1928. Based upon this conservative estimate, the yearly production of women's full-fashioned hosiery will have not only doubled from 1919 to 1925, but increased over 81 per cent in 1928 compared with 1925; in other words, the industry has increased its 1928 yearly production to a figure that is over three and one-half times the 1919 output.

Table 2 also shows the increase in value at the completion of manufacture of the total production of women's full-fashioned hosiery. In 1923 the total value was 249 per cent of the 1919 value, an even greater rate of increase of value than of quantity of output for these years. This difference is easily explained since, as will be shown later,[11] the full-fashioned product has been manufactured to an increasingly greater extent of silk and silk mixtures instead of cotton. In spite of the increased value of the total output and the trend toward the use of silk, the average value of a dozen pairs of women's full-fashioned hosiery showed a decline in 1925, compared to 1923, and only a very slight gain in 1927 over 1925. The increased production was sold at a decreased price per unit, although other factors such as the price of silk may have played a part.

It is interesting to compare the increases in the production of the full-fashioned hosiery industry with those in other industries of the United States. In his recent book, *Industry's Coming of Age*, Rexford G. Tugwell presents [12] a table of the indices of quantity production of certain of the "major

[10] The total monthly outputs as reported by the limited number of firms in 1925 and 1927 comprised 78.1 per cent of the actual figure reported by the 1925 *Census of Manufactures*, and 75.4 per cent of the total of 1927.

[11] See page 35.

[12] Page 14.

economic industries" of the country, based upon the fiscal year ending June 30, 1919, as 100. This material is here partially reproduced as Table 3.

TABLE 3

INDICES OF PRODUCTION OF MAJOR ECONOMIC INDUSTRIES OF THE UNITED STATES

(Based upon fiscal year ending June 30, 1919–100)

| | Years Ending June 30 | | | | |
|---|---|---|---|---|---|
| | 1919 | 1923 | 1924 | 1925 | 1926 |
| Manufacturing production | 100 | 116 | 115 | 118 | 126 |
| Mineral production | 100 | 119 | 133 | 129 | 132 |
| Forest products production | 100 | 117 | 122 | 121 | 124 |
| Freight, railroad, ton miles | 100 | 109 | 110 | 110 | 120 |
| Electric power production | 100 | 186 | 148 | 158 | 179 |
| Building contracts let, square feet | 100 | 107 | 108 | 112 | 142 |

Compared with the growth in other industries, that in the full-fashioned hosiery industry has been very rapid indeed. We have noted that from 1919 to 1925 the yearly production of full-fashioned hosiery was doubled. During the same interval, Table 3 shows that all manufacturing production in the United States increased 18 per cent, and that even the very rapidly growing annual production of electric power increased but 58 per cent. Certainly the full-fashioned hosiery industry, as measured by volume of annual output, has been at least one of the most rapidly growing industries of the country. This fact alone urges a study of the industry, and especially a study of the possibility of changed management problems.

It would be interesting to compare the annual production of women's full-fashioned with that of seamless hosiery in like manner, although it is impossible to secure census data on women's seamless hosiery before 1927. Previous to that year, the *Census of Manufactures* did not separate the production data on the women's seamless from that of children's and infants' hosiery. Accordingly, in Table 4 we have only been able to list, for census years, the production of all seamless hosiery (excluding half-hose). This shows that

seamless production generally has not experienced the same expansion that trebled the full-fashioned output in a comparatively few years.

TABLE 4

PRODUCTION OF SEAMLESS HOSIERY IN THE UNITED STATES

1919 to 1928[13]

(Includes Women's, Children's and Infants' Hosiery Production)

| Year | Dozen Pairs | Relative Dozen Pairs | Value | Relative Value | Average Value of One Dozen Pairs |
|---|---|---|---|---|---|
| 1919..... | 45,101,406 | 100 | $160,193,360 | 100 | $3.55 |
| 1921..... | 44,490,667 | 98.6 | 140,122,112 | 87.4 | 3.14 |
| 1923..... | 49,797,393 | 110.4 | 157,283,595 | 98.1 | 3.16 |
| 1925..... | 47,306,165 | 104.8 | 161,622,395 | 100.8 | 3.41 |
| 1927..... | 45,918,828 | 101.8 | 131,202,911 | 81.9 | 2.86 |
| 1927 in Detail | | | | | |
| Women's.. | 24,945,998 | | 86,897,040 | | 3.48 |
| Children's.. | 14,169,137 | | 31,394,679 | | 2.22 |
| Infants'.... | 6,803,693 | | 12,911,192 | | 1.90 |
| Total..... | 45,918,828 | | 131,202,911 | | |

This table emphasizes the rapidity of the growth of full-fashioned hosiery production, since the absolute production of the entire seamless group remained practically constant from 1919 to 1927 while that of full-fashioned hosiery was increasing two and one-half times. In the seamless industries, the total value of production and the average value of one dozen pairs actually decreased in 1927, the total value declining from a relative of 100.8 in 1925 to 81.9 in 1927, although the quantity produced remained almost constant.

It is true that, considering Table 4 alone, it may have been possible for women's seamless to increase and for this increase to have been obscured by a corresponding decrease in children's and infants' hosiery. Table 7,[14] however, serves to supplement the present evidence to show that the

[13] *Biennial Census of Manufactures* for the years indicated.

[14] See page 22.

yearly output of women's seamless hosiery actually decreased between 1923 and 1928.

A classification of seamless hosiery by the type of stocking produced was first made in the 1927 *Census of Manufactures.* Below the 1927 production in Table 4, this detailed information is listed. It will be seen that over one-half of the total seamless hosiery output is for the use of women; and, more striking, the 1927 production of women's seamless hosiery of 24,945,998 dozen pairs exceeded the 1927 full-fashioned output of 19,771,030 by 5,171,968 dozen pairs. However, the average value of one dozen pairs of the full-fashioned product was $11.50 while the average value of women's seamless hosiery was but $3.48. In 1927 the average value of women's seamless was considerably higher than the average value of the entire seamless group, probably because of a greater use of silk and because of the larger size of women's hosiery. If a like situation prevailed in previous years, it is evident that the average price of women's seamless hosiery declined greatly in 1927.

In order to study in more detail the increased production of full-fashioned hosiery and to note, as was previously impossible, the trend in production of women's seamless hosiery, Tables 5 and 7 are presented. Since February 1923, the Department of Commerce has issued monthly reports of hosiery production, which classify production according to materials, as well as by type, i.e., women's, men's and children's. These figures are of peculiar value to anyone studying the full-fashioned hosiery industry, since they are based upon a large enough proportion of the production of the entire industry to be considered as representative. Our study of these figures will begin with January 1924, inasmuch as the reports for 1923 cannot be readily compared with those of subsequent years. The 1923 reports do not begin until February, and, even if the total production reported in that year were increased by one-eleventh to place the output on a yearly basis, it would represent but 61.3

per cent of the actual production for the year 1923, as later compiled by the *Census of Manufactures*. On the other hand, the Department of Commerce monthly returns for 1925 included a production of 9,608,754 dozen pairs of full-fashioned hosiery, which was 78 per cent of the actual production; the *Census of Manufactures* for 1925 reported a total production of 12,291,219 dozen pairs. Monthly reports in 1927 included 75 per cent of the census figures on production of full-fashioned hosiery for the same year.

As the 1923 monthly figures are not complete for the entire year and, as compared with those of 1925 and 1927, include a much smaller sample of the total production, they will not be used in this study. The year 1924 will be used as a base in considering monthly production.

Difficulty was experienced in the use of the monthly data on account of the variation in the number of establishments reporting from month to month. Each month, however, the production of an identical number of establishments for the current month and for the previous month was reported. These figures for identical establishments were used to secure a monthly percentage of increase or decrease. Considering January 1924 production as 100, an index for February 1924 was secured by increasing the base by the rate of increase of production for February over January, or by decreasing the base by the rate of decrease of actual production figures. The February index was then increased by the March rate of increase to secure the March index. In this manner a series of indices was developed for the monthly production of women's full-fashioned and seamless hosiery. The indices for full-fashioned production are noted in Table 5, along with the production figures used and the monthly percentage of change. An arithmetic average, computed from the monthly indices, gives a general idea of the production level of each year. Our justification for using this average of ratios rests upon the check of their accuracy made in Table 6.

TABLE 5

MONTHLY PRODUCTION OF WOMEN'S FULL-FASHIONED HOSIERY IN THE UNITED STATES

1924 to 1928

(Based upon January 1924 Production—100)

| Year and Month | Production in Dozen Pairs | | Monthly Percentage of Growth | Monthly Index | Yearly Index of Production* |
|---|---|---|---|---|---|
| | Current Month | Past Month | | | |
| *1924* | | | | | |
| Jan. | 536,712 | | | 100.0 | |
| Feb. | 562,172 | 536,712 | 4.7 | 104.7 | |
| Mar. | 590,977 | 553,514 | 6.8 | 111.8 | |
| Apr. | 601,654 | 603,601 | — .3 | 111.5 | |
| May | 619,416 | 606,354 | 2.2 | 113.9 | |
| June | 539,789 | 607,005 | —11.1 | 101.3 | |
| July | 475,029 | 540,139 | —12.1 | 89.0 | |
| Aug. | 454,021 | 458,066 | — .9 | 88.2 | |
| Sept. | 504,092 | 455,929 | 10.6 | 97.6 | |
| Oct. | 656,536 | 500,512 | 31.2 | 128.0 | |
| Nov. | 599,224 | 647,398 | — 7.4 | 118.6 | |
| Dec. | 675,277 | 608,436 | 11.0 | 131.6 | 108.0 |
| *1925* | | | | | |
| Jan. | 670,077 | 667,386 | .4 | 132.1 | |
| Feb. | 690,195 | 682,247 | 1.2 | 133.7 | |
| Mar. | 737,414 | 661,113 | 11.5 | 149.1 | |
| Apr. | 768,074 | 733,723 | 4.7 | 156.1 | |
| May | 761,828 | 773,959 | — 1.6 | 153.6 | |
| June | 810,738 | 776,102 | 4.5 | 160.5 | |
| July | 817,655 | 806,201 | 1.4 | 162.8 | |
| Aug. | 822,793 | 815,905 | .8 | 164.1 | |
| Sept. | 833,252 | 825,891 | .9 | 165.5 | |
| Oct. | 947,608 | 838,827 | 13.0 | 187.1 | |
| Nov. | 844,567 | 933,012 | — 9.5 | 169.3 | |
| Dec. | 904,453 | 825,492 | 9.6 | 185.5 | 160.0 |
| *1926* | | | | | |
| Jan. | 868,769 | 940,262 | — 7.6 | 171.4 | |
| Feb. | 906,491 | 880,891 | 2.9 | 176.4 | |
| Mar. | 1,075,111 | 913,386 | 17.7 | 207.6 | |
| Apr. | 1,021,162 | 1,053,579 | — 3.1 | 201.2 | |
| May | 1,000,787 | 1,025,821 | — 2.4 | 196.4 | |
| June | 1,055,962 | 994,537 | 6.2 | 208.5 | |
| July | 943,493 | 1,042,139 | — 9.5 | 188.7 | |
| Aug. | 1,039,217 | 954,376 | 8.9 | 205.5 | |
| Sept. | 1,061,350 | 1,040,244 | 2.0 | 209.6 | |
| Oct. | 1,151,736 | 1,066,689 | 8.0 | 226.4 | |
| Nov. | 1,114,764 | 1,151,736 | — 3.2 | 219.2 | |
| Dec. | 1,126,986 | 1,098,620 | 2.6 | 224.9 | 203.0 |

* Arithmetic average of monthly indices.

TABLE 5—*Continued*

| Year and Month | Production in Dozen Pairs | | Monthly Percentage of Growth | Monthly Index | Yearly Index of Production* |
|---|---|---|---|---|---|
| | Current Month | Past Month | | | |
| *1927* | | | | | |
| Jan. | 1,113,611 | 1,110,477 | .3 | 225.5 | |
| Feb. | 1,125,429 | 1,131,571 | − .5 | 224.4 | |
| Mar. | 1,325,386 | 1,132,216 | 17.1 | 262.8 | |
| Apr. | 1,221,441 | 1,335,731 | − 8.6 | 240.2 | |
| May | 1,218,458 | 1,215,747 | .2 | 240.7 | |
| June | 1,329,568 | 1,227,610 | 8.3 | 260.6 | |
| July | 988,414 | 1,324,993 | −25.4 | 194.4 | |
| Aug. | 1,241,470 | 1,000,764 | 24.1 | 241.3 | |
| Sept. | 1,284,996 | 1,249,361 | 2.9 | 248.3 | |
| Oct. | 1,351,837 | 1,286,008 | 5.1 | 261.0 | |
| Nov. | 1,393,699 | 1,361,107 | 2.4 | 267.2 | |
| Dec. | 1,313,730 | 1,394,109 | − 5.8 | 251.7 | 243.1 |
| *1928* | | | | | |
| Jan. | 1,367,246 | 1,304,417 | 4.8 | 263.8 | |
| Feb. | 1,401,999 | 1,384,826 | 1.2 | 267.0 | |
| Mar. | 1,549,064 | 1,401,434 | 10.5 | 295.0 | |
| Apr. | 1,448,193 | 1,547,829 | − 6.4 | 276.1 | |
| May | 1,541,705 | 1,441,343 | 7.0 | 295.5 | |
| June | 1,474,470 | 1,563,563 | − 5.7 | 278.6 | |
| July | 1,167,663 | 1,469,470 | −20.5 | 221.5 | |
| Aug. | 1,510,395 | 1,189,777 | 26.9 | 281.1 | |
| Sept. | 1,384,455 | 1,502,054 | − 7.8 | 259.2 | |
| Oct. | 1,733,629 | 1,387,530 | 24.9 | 323.7 | |
| Nov. | 1,709,376 | 1,759,936 | − 2.9 | 314.3 | |
| Dec. | 1,515,422 | 1,729,228 | −12.4 | 275.3 | 279.3 |
| *1929* | | | | | |
| Jan. | 1,725,278 | 1,484,422 | 16.2 | 319.9 | |
| Feb. | 1,670,270 | 1,736,319 | − 3.8 | 307.7 | |
| Mar. | 1,793,171 | 1,656,893 | 8.2 | 332.9 | |
| Apr. | 1,772,253 | 1,776,015 | − .2 | 332.2 | |
| May | 1,859,660 | 1,771,984 | 4.9 | 348.5 | |
| June | 1,659,504 | 1,866,277 | −11.1 | 309.8 | |

* Arithmetic average of monthly indices.

Considering the yearly indices of Table 5 as representative of each year's production, it is interesting to study the rates at which the production of full-fashioned hosiery has been increasing. These rates are measures of rapidity of growth and are presented in Table 6. This table also compares the results secured from our use of both the *Census of Manufactures* figures and the monthly Department of Commerce reports.

TABLE 6

PRODUCTION OF WOMEN'S FULL-FASHIONED HOSIERY IN THE UNITED STATES
1924 to 1928

| Year | Based on Department of Commerce Monthly Reports | | | | Based on Census Reports | |
|---|---|---|---|---|---|---|
| | Yearly* Indices | Relative Indices 1924 as 100 | Rates of Increase over Previous Year | Relative 1925 as 100 | Dozen Pairs | Relative 1925 as 100 |
| 1924..... | 108.0 | 100 | | | | |
| 1925..... | 160.0 | 148.1 | 48.1 | 100 | 12,291,219 | 100 |
| 1926..... | 203.0 | 188.0 | 26.9 | 126.9 | | |
| 1927..... | 243.1 | 225.1 | 19.8 | 152.2 | 19,771,030 | 160.8 |
| 1928..... | 279.3 | 258.6 | 14.9 | 174.6 | 22,254,520 | 181.1 |

* From Table 5.

The production data so developed from the monthly reports are valuable in giving a measure of yearly and even monthly growth, while census figures show only bi-yearly fluctuations. In order to test the method used in handling the monthly data, we have, in Table 6, compared the measure of growth developed from the monthly figures with that based upon biennial census figures. Considering the 1925 index from Table 5 as 100, we find the 1928 index would be approximately 175. The actual *Census of Manufactures* production figures for 1925 and 1927, and our estimated production for 1928, have also been computed with 1925 production as 100. The variation of the indices based upon our handling of monthly data from the Census indices is but 5.3 per cent of the actual index in 1927 and 3.6 per cent in 1928. This only means of checking our method of handling the monthly figures seems to indicate that our procedure has given a valid result. The slight variation noted above will not affect our conclusions, especially since the monthly indices will be used mainly to study seasonality in the full-fashioned branch of the industry, as well as the production trend in women's seamless hosiery. Only in the monthly figures is the production of the seamless product isolated.

The yearly production of full-fashioned hosiery has in-

creased constantly, though at varying rates. The year 1925 was a year of very rapid expansion. In that year, production increased at a rate not since equalled. Actually, yearly increases have been made at a decreasing rate each year since 1925. In spite of the constantly mounting production, however, the yearly percentage of increase is being maintained at a high rate. A 15 per cent increase in 1928 over an already large 1927 production is a large increase.

The monthly reports give us our only estimate of the trend in the production of women's seamless hosiery. In considering seamless production, we have used a monthly index computed as explained in the consideration of the monthly production of full-fashioned hosiery. The reporting conditions were the same for both types of hosiery. Table 7 presents the indices for monthly production of women's seamless hosiery, as well as yearly indices of production that are arithmetic averages of the monthly indices. Our reason for presenting this material is that it affords an opportunity of comparing the large increases in full-fashioned hosiery with those in an allied industry, and also makes it possible to understand whether or not the increase in full-fashioned production was accompanied by a decreasing use of other hosiery products.

With January 1924 production considered as 100, the 1924 average index is computed at 88. An increase to 115 in 1925 was substantial and explainable by the fact that business conditions generally in 1924 were somewhat depressed. After 1925, the production of women's seamless hosiery showed a steady decline that culminated in a really sharp drop in 1928 to a yearly average of 65. Even allowing for a slight variation from actuality because of our method of treating these monthly reports, we can say rather definitely that the production of women's seamless hosiery has not increased as has that of full-fashioned. Moreover, while full-fashioned production expanded rapidly from 1925 to 1928 (about 81 per cent), women's seamless production declined from an index of 115.0 to 65.0, a decline

TABLE 7

MONTHLY PRODUCTION OF WOMEN'S SEAMLESS HOSIERY IN THE UNITED STATES

1924 to 1928

| Year and Month | Production in Dozen Pairs | | Monthly Percentage of Growth | Monthly Index of Production | Yearly Index of Production* |
|---|---|---|---|---|---|
| | Current Month | Past Month | | | |
| *1924* | | | | | |
| Jan. | 1,197,092 | | | 100.0 | |
| Feb. | 1,112,838 | 1,197,092 | − 7.0 | 93.0 | |
| Mar. | 1,112,062 | 1,103,850 | .7 | 93.7 | |
| Apr. | 1,040,107 | 1,112,052 | − 6.5 | 87.6 | |
| May | 1,076,120 | 1,037,103 | 3.8 | 90.9 | |
| June | 994,391 | 1,057,101 | − 5.9 | 85.5 | |
| July | 880,622 | 995,295 | −11.5 | 75.7 | |
| Aug. | 860,438 | 883,876 | − 2.7 | 73.7 | |
| Sept. | 926,930 | 860,438 | 7.7 | 79.3 | |
| Oct. | 1,083,922 | 912,456 | 18.8 | 94.2 | |
| Nov. | 1,055,127 | 1,069,254 | − 1.3 | 93.0 | |
| Dec. | 1,005,162 | 999,268 | .6 | 93.6 | 88.4 |
| *1925* | | | | | |
| Jan. | 1,078,931 | 991,135 | 8.9 | 101.9 | |
| Feb. | 1,114,610 | 1,086,373 | 2.6 | 104.5 | |
| Mar. | 1,363,352 | 1,128,594 | 20.8 | 126.3 | |
| Apr. | 1,288,373 | 1,360,884 | − 5.3 | 119.6 | |
| May | 1,348,746 | 1,290,008 | 4.6 | 125.1 | |
| June | 1,306,376 | 1,326,496 | − 1.5 | 123.2 | |
| July | 1,235,701 | 1,307,917 | − 5.5 | 116.4 | |
| Aug. | 1,122,601 | 1,152,085 | − 2.6 | 113.4 | |
| Sept. | 1,206,631 | 1,188,666 | 1.5 | 115.1 | |
| Oct. | 1,251,150 | 1,211,320 | 3.3 | 118.9 | |
| Nov. | 1,190,728 | 1,287,569 | − 7.5 | 110.0 | |
| Dec. | 1,085,811 | 1,151,325 | − 5.7 | 103.7 | 114.8 |
| *1926* | | | | | |
| Jan. | 1,010,583 | 1,085,792 | − 6.9 | 96.6 | |
| Feb. | 1,051,334 | 1,041,437 | 1.9 | 97.5 | |
| Mar. | 1,188,671 | 1,060,881 | 12.0 | 109.2 | |
| Apr. | 922,764 | 1,118,080 | −17.5 | 90.1 | |
| May | 890,124 | 922,764 | − 3.5 | 87.0 | |
| June | 933,405 | 890,274 | 4.8 | 91.1 | |
| July | 862,993 | 879,614 | − 1.9 | 89.4 | |
| Aug. | 1,013,094 | 948,802 | 6.8 | 95.5 | |
| Sept. | 1,071,114 | 1,001,263 | 7.0 | 102.2 | |
| Oct. | 1,106,402 | 1,063,426 | 4.0 | 106.3 | |
| Nov. | 1,041,067 | 1,106,449 | − 5.9 | 100.0 | |
| Dec. | 884,283 | 1,023,126 | −13.6 | 86.4 | 95.9 |

* Arithmetic average of monthly indices.

TABLE 7—*Continued*

| Year and Month | Production in Dozen Pairs | | Monthly Percentage of Growth | Monthly Index of Production | Yearly Index of Production* |
|---|---|---|---|---|---|
| | Current Month | Past Month | | | |
| *1927* | | | | | |
| Jan. | 879,806 | 855,775 | 2.8 | 88.8 | |
| Feb. | 763,003 | 879,806 | −13.3 | 77.0 | |
| Mar. | 813,168 | 710,849 | 14.4 | 88.1 | |
| Apr. | 821,807 | 865,214 | − 5.0 | 83.7 | |
| May | 822,793 | 795,766 | 3.4 | 86.5 | |
| June | 918,226 | 855,538 | 7.3 | 92.9 | |
| July | 687,972 | 963,241 | −28.6 | 66.3 | |
| Aug. | 962,818 | 727,710 | 18.5 | 87.7 | |
| Sept. | 891,972 | 886,734 | .6 | 88.2 | |
| Oct. | 940,023 | 915,042 | 2.7 | 90.6 | |
| Nov. | 837,931 | 941,831 | −11.0 | 80.6 | |
| Dec. | 623,043 | 845,063 | −26.3 | 59.4 | 82.5 |
| *1928* | | | | | |
| Jan. | 718,877 | 609,188 | 18.0 | 70.1 | |
| Feb. | 643,331 | 686,708 | − 6.3 | 65.7 | |
| Mar. | 651,280 | 643,437 | 1.2 | 66.5 | |
| Apr. | 606,076 | 651,280 | − 6.9 | 61.9 | |
| May | 637,149 | 606,076 | 5.1 | 65.1 | |
| June | 620,751 | 646,411 | − 4.0 | 62.5 | |
| July | 581,516 | 620,751 | − 6.3 | 58.5 | |
| Aug. | 666,183 | 563,680 | 18.2 | 69.2 | |
| Sept. | 645,031 | 667,183 | − 3.3 | 66.9 | |
| Oct. | 775,404 | 678,159 | 14.3 | 76.5 | |
| Nov. | 718,334 | 778,434 | − 7.7 | 70.6 | |
| Dec. | 504,784 | 735,185 | −31.3 | 48.5 | 65.2 |
| *1929* | | | | | |
| Jan. | 605,779 | 526,323 | 15.1 | 55.8 | |
| Feb. | 576,860 | 610,186 | − 5.5 | 52.7 | |
| Mar. | 627,155 | 576,860 | 8.7 | 57.3 | |
| Apr. | 678,129 | 628,103 | 8.0 | 61.9 | |
| May | 727,484 | 679,604 | 7.1 | 66.3 | |
| June | 762,343 | 722,645 | 5.5 | 70.0 | |

* Arithmetic average of monthly indices.

of over 43 per cent. It seems very evident that in the years 1925 to 1928, the production of women's full-fashioned hosiery was not only increasing, but was expanding to some extent because of a decreased use of seamless hosiery.

As the yearly percentage of increase of full-fashioned production was interesting, so are the ratios of decrease of yearly seamless production. These are indicated in Table 8.

After the slack times of 1924, a large rate of increase boomed the seamless industry in 1925. The decreases were

TABLE 8

INDEX OF PRODUCTION OF SEAMLESS HOSIERY IN THE UNITED STATES

1924 to 1928

| Year | Average Yearly Index | Relative 1924 as 100 | Rate of Change over Previous Year |
|---|---|---|---|
| 1924 | 88.4 | 100 | |
| 1925 | 114.8 | 130.0 | +30.0 |
| 1926 | 95.9 | 108.6 | −16.5 |
| 1927 | 82.5 | 93.3 | −14.1 |
| 1928 | 65.2 | 73.8 | −21.0 |

of about the same sharpness in 1926 and 1927. However, in 1928 full-fashioned production cut sharply into the seamless field, for in that year the production of seamless hosiery decreased 21 per cent of the 1927 total.

The early months of 1929 show no revival of activity in the women's seamless field. The monthly indices for the first four months are each below the yearly average of 1928, while an opposite condition prevails in the full-fashioned industry. It is quite possible, however, that seamless production may increase in the later months of 1929 on account of the rapidity with which "bare leg" hosiery has attracted popular fancy.

The trend of production of both full-fashioned and seamless hosiery, and a picture of seasonal trends, can best be visualized by an analysis of Chart I, which shows the monthly indices of production developed in Tables 5 and 7.

In 1924, when seamless production was at a comparatively low ebb, and when even the full-fashioned industry had difficulty in increasing production, the major seasonal movements were shared alike by both full-fashioned and seamless. It is usually not recognized that in 1924 the production of full-fashioned was affected strongly by seasonal fluctuations,[15] and failed to show the steady growth

[15] Several manufacturers of full-fashioned hosiery have related how their boards of directors seriously discussed the overdevelopment of their industry at the close of 1924 and even laid plans for meeting saturation problems at that time.

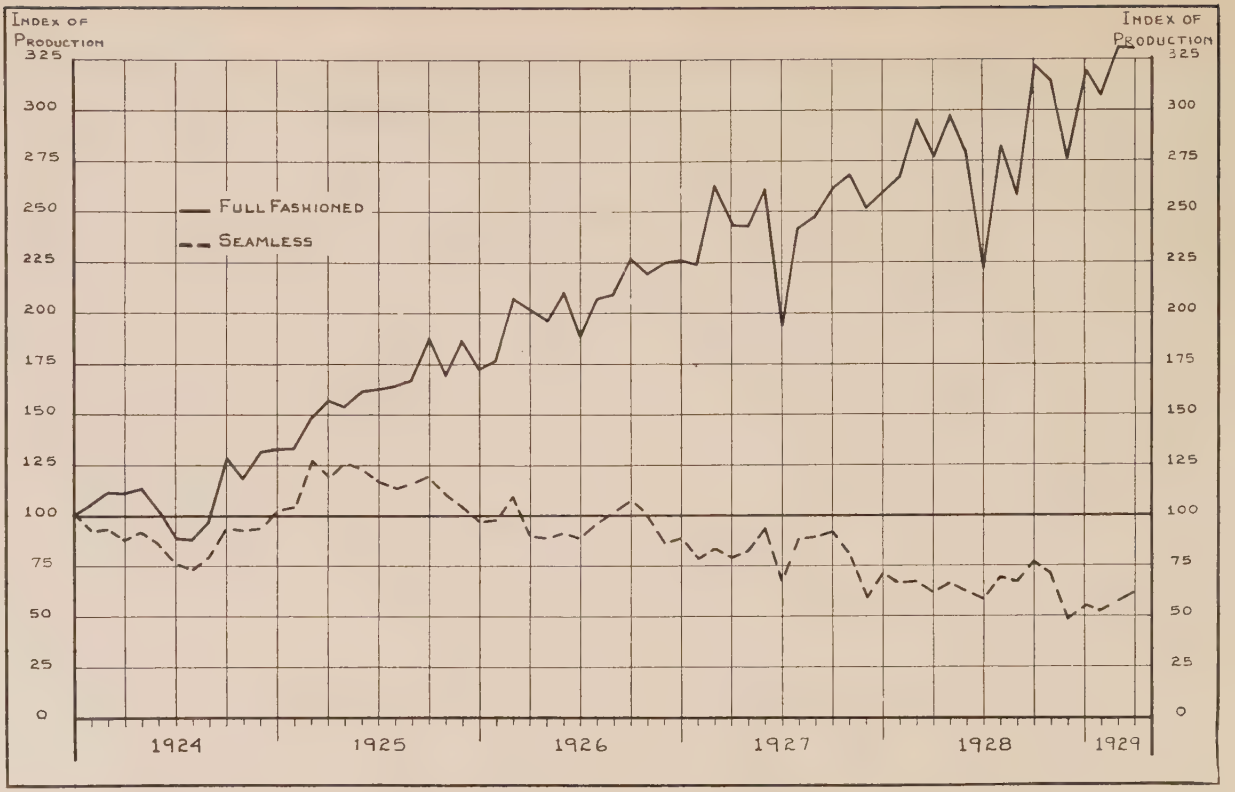


CHART I.* INDICES OF MONTHLY PRODUCTION OF WOMEN'S HOSIERY IN THE UNITED STATES—1924-1928 BASE—JANUARY, 1924

* From monthly reports of production issued by the United States Department of Commerce, Washington, D. C.

that it recorded in 1925. To be sure, in the years considered, 1925 was the only year that showed increased production of full-fashioned without seasonal increases. Another point of view might be that 1925 was an abnormal year. In any event, further production of full-fashioned hosiery brought changed conditions after 1925.

Of 1923, a full-fashioned manufacturer wrote, "On account of apparently a surplus production of silk hosiery . . . during the months of January and February, in the face of something like a 50 per cent advance in the cost of silk, several full-fashioned knitters reduced their prices slightly." [16]

The president of a large full-fashioned hosiery plant summarized activity of the year 1924 by stating: "The outstanding fact is that 1924 was emphatically an unsuccessful year for the manufacturer of textiles in general and silk hosiery in particular. . . . The principal cause of this unfavorable condition was the over-expansion in the industry which has led to over-production and consequently lower and more unstable prices. . . . In the past few years, the demand has changed rapidly from a long-wearing cotton hose to the less durable silk hose. This naturally resulted in a greater per capita consumption, and, therefore, developed an abnormal market expansion. . . . The results of the past year [1924] indicate that this abnormal expansion about reached its limit and the industry is settling down to a basis comparable to that of other well-established industries where the buyer's market is the rule." [17]

But the pessimistic forecasts failed to materialize. In 1925 there occurred a rapid increase in full-fashioned production and the elimination of marked seasonal fluctuations. "In the month of June 1925, there seemed to be an actual

[16] Fred, T. Walter, president, Davenport Hosiery Mills, Chattanooga, Tenn., in a report on Hosiery for the 1924 Annual Report of the Silk Association of America.

[17] Freschl, Edward, president, Holeproof Hosiery Co., Milwaukee, Wis., in a Hosiery report for the 1925 Annual Report of the Silk Association of America.

scarcity in the full-fashioned hosiery market." [18] About June 1925 the increased production of full-fashioned hosiery led to a noticeable decrease of seamless output. Continued expansion in the former field was, from that time, accompanied by a decreased output of seamless.

What was it that happened in 1925 to cause this situation? One of the leading manufacturers of women's full-fashioned hosiery wrote at the end of 1925: "The years 1923 and 1924 were exceptionally dull and noted particularly for tremendous competition caused by over-production. This condition covered the entire industry. . . . 1925 was not only one of the largest years in regard to volume, but also a very profitable one. . . . The short skirts, along with shoe styles, made it almost imperative for a woman to wear the best hosiery she could possibly afford. Silk stockings, therefore, became more popular than ever before, and the finer and lighter weight, or chiffon stockings, were used in much larger quantities. Naturally because of their sheer quality, many more pairs were required. This is reflected in the volume of business done. Another interesting factor was the wide variation of colors." [19]

If this is a good explanation of the increase, then production figures should show a trend to the use of silk, and per capita consumption of full-fashioned hosiery should have increased in 1925 and subsequently, for the styles mentioned have become more pronounced since 1925. These two trends did occur, as is shown later.[20]

The style change to shorter skirts, about the beginning of 1925, thus caused an increased demand for silk hosiery. Both full-fashioned and seamless producers benefited by the demand and both increased their output during the first six months of the year. Then the superiority of the full-

[18] Gutman, Arthur S., president, Rivoli Silk Hosiery Co., New York, writing in a report on Hosiery for the 1926 Annual Report of the Silk Association of America.

[19] Oberlander, Gustav, secretary and treasurer, Berkshire Knitting Mills, writing a report on Knit Goods in the 1926 Annual Report of the Silk Association of America, page 69.

[20] See page 35.

fashioned stocking in holding its shape and its greater beauty resulted in a rapidly increasing use of this product and a decreasing use of the seamless.

The demand for full-fashioned hosiery led to increased production in each year from 1925 to 1928, and to a corresponding decreased use of seamless. The full-fashioned industry, however, is not free from problems. Demand and production have increased, but so has equipment. Furthermore, after 1925 and 1926, in which years no marked seasonality was experienced, the subsequent years have shown increasing seasonality. This is, of course, undesirable from a management point of view, since it necessitates idle equipment or over-time work.

Our analysis shows that the yearly production of women's full-fashioned hosiery increased approximately 81 per cent from 1925 to 1928, while seamless production decreased approximately 43 per cent during the same period. It must be borne in mind that full-fashioned production had already increased 55 per cent in yearly output from 1919 to 1923. As the census of manufactures is taken bi-yearly, no measures of the growth of 1924 production is at hand from census data, but statements by leaders of the industry have shown that 1924 was an unsuccessful year on account of the abnormal expansion of both 1923 and 1924. However, volume of production increased somewhat, even in 1924.

We have seen that style factors were very favorable for a hosiery boom in 1925. The short skirt made fine appearance a necessity in hosiery. Stockings could not be satisfactorily mended; hence they had to be replaced more frequently. The color trend required more stockings per wardrobe in order to match various costumes, and, as light colors were the vogue, more frequent laundering lessened the life of each pair. Of real importance to the increased use of hosiery was the discovery that, to be well-dressed, sheer hosiery was a necessity. It is generally thought that chiffon hosiery wears out more quickly than service weights. Women could also afford to spend more money for hosiery,

a conspicuous part of the costume, as style decreed less expenditure for other portions of the costume.

Besides the favorable style factors, 1925 was characterized by a general business boom, influenced perhaps by our rich harvest and the European crop failure of that year. The tariff imposed by England upon silk and rayon hosiery, effective July 1, 1925,[21] possibly had some effect on the 1925 boom of full-fashioned. Manufacturers have remarked that early in 1925, an extraordinary amount of hosiery was shipped into England before the imposition of a protective tariff on hosiery.

Even 1926, which suffered no wide seasonal fluctuations, experienced a decrease at the beginning of the year and two summer declines, while the only 1925 decrease of note was in November. Full-fashioned production was higher but still more erratic in 1927, with big decreases in production in April and May and a sharp drop in July. In 1928 the fluctuations in production became even more violent than in 1927. We can say, therefore, that since 1925, when production increased without noticeable seasonal fluctuations, increased production of full-fashioned hosiery has been attained at the cost of seasonal variations becoming more and more noticeable. If production attains an index of 263.8 in January, 295 in March and 215 in July, 259.2 in September and 323.7 in October, as was true in 1928, it must be inferred that the industry is either working its equipment over time in the busy months or under time in the dull ones. Either situation is undesirable from the point of view of management, which desires an even flow of production.

Another approach might consider the year 1925 as an abnormal year, since only then were seasons non-existent. This point of view would consider that the full-fashioned industry was returning to normal in 1926 and thereafter. However, it is impossible to overlook the fact that changes

[21] Egerton, K. A. H., and Flake, Wilson, *The British Market for Hosiery*, Department of Commerce Trade Information Bulletin No. 495, page 2. Before June 1925, all classes of hosiery had entered England free of duty. A 33 1/3 per cent import tax was levied in 1925.

have occurred since 1925 that render management problems more difficult than previously. Manufacturers cannot expect to be mere order-takers at present.

The especially rapid increase of full-fashioned production in 1926, 1927 and 1928 was accompanied by a decreased production of seamless hosiery which reached its low ebb in December 1928, when the index of production, based upon the production of January 1924 as 100, dropped to 48.

It remains to note that the increased production of full-fashioned hosiery was not largely for export purposes. Had exports increased to large proportions while production was increasing, there might have been no increased supply for home consumption. Previous to January 1928, the *Monthly Summary of Foreign Commerce of the United States* reported exports of hosiery, classified according to type of material but not differentiating between full-fashioned and seamless. In 1928 the grouping by material was retained, but exports of full-fashioned and seamless silk hosiery were listed separately. In 1928 the total of the monthly exports of women's full-fashioned silk hosiery was 657,467 dozen pairs.[22] Other full-fashioned hosiery of rayon, cotton or mixtures was probably also exported but no data on it are available. However, in 1928, nearly 95 per cent of the full-fashioned women's hosiery produced was made of silk or silk with cotton tops, heels and toes,[23] so that exports of full-fashioned hosiery of other material than silk could not have been of large proportions. Of a total estimated production of 22,254,520 dozen pairs of full-fashioned hosiery in 1928,[24] 657,467 dozen pairs of silk hosiery, or about 3 per cent, were exported.[25] We may safely assume that exports have not absorbed a large percentage of the production of full-fashioned hosiery, although it is possible that

[22] Department of Commerce, *Monthly Summary of Foreign Commerce*, 1927, 1928.

[23] See page 36.

[24] See page 12.

[25] It has been reported that a large proportion of these exports were for American tourist trade abroad.

the export field, now barely touched, offers possibilities for future development.[26]

Imports of full-fashioned hosiery need not be considered as a factor in the increased use of this product in the United States. Like most of the export data, imports are classified only by type of material.[27] That little silk full-fashioned hosiery is imported, is evidenced by its inclusion in government figures under the classification "Imports of silk wearing apparel—knit or crocheted." The total imports of this classification in 1927 were valued at only $380,114 and in 1928 at $246,379. Wool hosiery, both seamless and full-fashioned, was imported to the extent of 383,917 dozen pairs in 1927 and 370,703 dozen pairs in 1928, while cotton hosiery imports, both full-fashioned and seamless, were 527,909 dozen pairs in 1927 and 730,521 dozen pairs in 1928. Imports of rayon hosiery are so small, if there are any, that they are included under "all other rayon manufactures." Each type of import mentioned is so small, and includes items other than full-fashioned hosiery, that we can assume that imports are a negligible factor in the study of the increased use of full-fashioned in the United States.

So far, our study has considered the increased production of women's full-fashioned hosiery in the United States from 1919 to 1928. The growth was rapid from 1919 to 1923, but was apparently slowing up in 1923 and 1924 when apprehension concerning overdevelopment and saturation was expressed, and when seasonality was evident. A combination of favorable factors revived the growth and continued production in subsequent years at an even greater rate of increase. However, the greater output was marketed only by taking over part of the seamless field, as was made possible, by style changes. It is also possible that a

[26] *Knitting Mill News* of February 1929 points out editorially on page 85 that the possibility of developing an export market for full-fashioned hosiery in South America has been made more certain by Herbert Hoover's goodwill visit. Australia is also considered as a potential market for the coarser type of hosiery that is becoming passé in the United States.

[27] *Monthly Summary of Foreign Commerce*, 1927, 1928.

decreased price of full-fashioned hosiery made this "invasion" practical, for we have seen that the average value of full-fashioned hosiery decreased in 1925 as compared with 1923, although the average value of a dozen pairs of seamless hosiery increased in the two years mentioned.

With so many favorable demand factors, the average value of full-fashioned hosiery decreased, and although the style trends of color, sheerness and type of material continued through 1926, 1927, and 1928, there seems to be a growing seasonality in full-fashioned production. In other words, production seems to be keeping up with, or going beyond, consumption. A summary of the year 1925 made by Arthur S. Gutman states, "When, with so many favorable factors, there was no scarcity in the full-fashioned hosiery market, it is quite evident there is no underproduction." [28]

It shall next be our purpose to test the explanations given for the increase of full-fashioned production. We shall study the trend in the type of materials used in manufacturing full-fashioned hosiery as well as the per capita consumption of both full-fashioned and seamless hosiery. Moreover, we must, if possible, explain the basic cause of the increasing seasonality of the full-fashioned hosiery industry. As productive equipment is still being added to the industry, we must estimate the various possibilities for absorbing an increasing output or for limiting the increased yearly output.

[28] *Op. cit.*

# CHAPTER III

## EVIDENCES OF CHANGED MANAGEMENT PROBLEMS

Our discussion so far has emphasized the rapidity of the growth of the full-fashioned hosiery industry in the United States from 1919 to 1928, and particularly from 1925 to 1928. Surely increased production is desirable. It means more goods for consumption, which in turn means more wealth and greater prosperity. The possible danger of such rapid growth lies in the fact that the unbridled development of an industry may result in a "misdirected production" that may lead to an increase in supply without a corresponding increase in schedule demand. Such a situation may result in a forced lowering of prices that may allow little or no profit and even force liquidation. Unorganized growth, therefore, may be uneconomic. The growth of an industry means wealth; but it may also mean disorganization and decreased wealth over a period of years.

Compared with that of other industries, the growth of the full-fashioned hosiery industry has been so rapid that a study of the characteristics of the growth becomes very pertinent. We should analyze the industry's development with a view to determining whether or not its expansion has led to new problems of management. Since rapid expansion under new conditions began with 1925, we will direct most of our attention to the factors of demand and production that were effective between 1925 and 1928.

After the boom year of 1925, the consumption of full-fashioned hosiery continued to increase; the demand factors responsible for the 1925 increase persisted. The latter fact is discernible from a study of trends in the material used in production and from a study of per capita consumption.

The continued use of silk, less durable than cotton, can

best be understood by a consideration of Table 9, which surveys the situation not only from 1925 to 1927 but also in previous years in order to test the explanation previously given for the 1925 increase.

In 1919, of all the women's full-fashioned hosiery manufactured, 46.5 per cent was made entirely of cotton, while but 14.8 per cent was all natural silk. Then came the very potent style trend toward silk that decreased the use of all cotton full-fashioned hosiery until in 1923 but 18.3 per cent of the total full-fashioned production was manufactured of cotton. Full-fashioned hosiery made of all natural silk has never been a very large percentage of the total production, but stockings made of all natural silk with cotton or lisle tops, heels and toes have contributed largely. This type of hosiery was not reported separately until 1925; before then it was included with other mixtures. That most of the "mixtures" classification before 1925 consisted of silk with cotton or lisle re-enforcements is evident from the 1925 census results, which, by listing this type separately, caused the virtual disappearance of "mixtures." The increase of "mixtures" from 37.5 per cent of the total production in 1919 to 63.8 per cent in 1925 seems to have been caused by an increased use of silk hosiery. Of course, the evidence is not conclusive, for changes may have occurred within the "mixtures" group as rapidly as within the cotton group.

However, even if all the "mixtures" reported in 1919, 1921 and 1923 were silk with lisle or cotton tops, heels and toes (as is not likely), the use of silk in full-fashioned hosiery for 1925 would still show a marked increase.

The percentage of total production supplied by the two groups of "all silk" and of "mixtures" was 52.3 per cent in 1919, 76.5 per cent in 1921 and 81.3 per cent in 1923. In 1925 the actual production of silk hose with lisle or cotton parts was given and represented 77.5 per cent of the total production, while all silk for the year represented 12 per cent—a total of 89.6 per cent of the 1925 output for

## TABLE 9

### Material Used in Manufacturing Full-Fashioned Hosiery[1]

1919 to 1927

| Year | Total Production Doz. Prs. | All Cotton | | All Wool | | All Natural Silk | | Silk with Cotton† | | Artificial Silk‡ | | Mixtures§ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Doz. Prs. | Per Cent of Total | Doz. Prs. | Per Cent of Total | Doz. Prs. | Per Cent of Total | Doz. Prs. | Per Cent of Total | Doz. Prs. | Per Cent of Total | Doz. Prs. | Per Cent of Total |
| 1919... | 6,323,934 | 2,940,641 | 46.5 | 26,974 | .4 | 935,463 | 14.8 | | | 49,680 | .8 | 2,371,176 | 37.5 |
| 1921... | 7,589,913 | 1,714,844 | 22.6 | 26,030 | .3 | 973,253 | 12.8 | | | 46,171 | .6 | 4,829,615 | 63.7 |
| 1923... | 9,817,996 | 1,795,618 | 18.3 | 37,462 | .4 | 1,720,376 | 17.5 | | | 5,840 | * | 6,258,700 | 63.8 |
| 1925... | 12,291,219 | 727,882 | 5.9 | 6,796 | * | 1,483,857 | 12.1 | 9,524,170 | 77.5 | 128,944 | 1.1 | 419,570 | 3.4 |
| 1927... | 19,771,030 | 371,484 | 1.9 | 11,439 | * | 3,079,374 | 15.6 | 14,758,140 | 74.6 | 94,598 | .5 | 1,455,995‖ | 7.4 |

* Less than 1/10 of 1 per cent.
† All natural silk with lisle or cotton tops, heels or toes.
‡ All artificial silk; and artificial silk with cotton tops, heels or toes. In 1919, 1921 and 1923, includes mixtures of both silk and artificial silk.
§ In 1919, 1921 and 1923 includes all silk with lisle or cotton parts, and artificial silk with lisle or cotton parts.
‖ 644,754 dozen pairs were of silk and rayon; 322,000 were silk and cotton; 198,692 were silk and wool.

[1] *Biennial Census of Manufactures*, Knit Goods, for the years indicated.

the two groups. It seems feasible to accept the view that the growth of full-fashioned production from 1919 to 1923 was accompanied by a decrease in the use of cotton hosiery and an increase in the use of silk. Moreover, we can say with even greater assurance that the 1925 production showed a further increased use of silk and a sharp decline in cotton full-fashioned hosiery, which dropped from 18.3 per cent of the total production in 1923 to 5.9 per cent in 1925. Style, making effective a demand for silk hosiery, can be said to have greatly influenced hosiery production in the boom year of 1925.

The demand for silk hosiery has continued to increase since 1925. The 1927 census figures show that 90.2 per cent of the total production for the year was manufactured of "all silk" and of "silk with lisle or cotton re-enforcements", compared with 89.6 per cent in 1925. Cotton full-fashioned hosiery consisted of only 1.9 per cent of the 1927 output, decreasing to this low point from 46.5 per cent of the total output in 1919.

The 1928 production that has been reported for a partial but representative list of establishments [2] shows no change in the kind of material demanded in hosiery. Of a production of 17,703,617 dozen pairs of women's full-fashioned hosiery so reported, 94.9 per cent were of "all silk" and of "all silk with lisle or cotton", while a mere .56 per cent were all cotton.

Since 1925, then, demand factors favorable to the increased use of full-fashioned hosiery have continued, inasmuch as the longer-wearing cotton hosiery has been and is being still further replaced by silk. Moreover, other conditions responsible for the 1925 boom have continued. Sheerness of increasing degree has become the vogue. In 1925, a 51-gauge stocking was thought to be the ultimate in sheerness; 1929 views the development of establishments specializing in the 57-gauge variety and knitting silk as fine as two-

[2] Department of Commerce, Washington, D. C. Monthly Report of Production, Orders and Stocks of Hosiery.

thread. Reports are current of a 60-gauge machine,[3] while one machine producer is contemplating a 66-gauge machine consisting of but four sections for making the sheerest French hosiery of one-thread silk. Later, in our analysis of machine equipment, we shall discover further evidence of a trend to sheerer hosiery from 1925 to 1927 in the increasing percentage of output of machinery of the finer gauges.

Light colors retained their popularity, while other style factors were introduced to make hosiery an article of shorter life. In 1927, a leading hosiery mill[4] staged a style show in Chicago. Speaking of that show, the producer stated, "If stockings can measure the length of the skirt, they can control the trend of fashion, and that is what has happened. Because of the increased style consciousness in hosiery, many novelties have been produced. . . . The most effective novelty and the one on which most business has been done is the pointed heel."[5]

Now we have not only the pointed heel, but the French heel, double pointed heels, and many other designs. The picot edge has been developed, and clocks have been revived from time to time. Net stockings flourished for a time and are still in some demand. Truly, the women's hosiery industry is being placed upon a millinery basis with style changes occurring seasonally.

It seems that most of the demand factors responsible for the 1925 increase have remained favorable since then. If this is so, a greater per capita consumption of full-fashioned hosiery must have occurred, not only from 1919 to 1925 but from 1925 to 1928 as well.

Table 10 is concerned with per capita consumption of women's full-fashioned and seamless hosiery from 1919 to 1928. The users of the type of hosiery mentioned are assumed to be females over ten. To be sure, girls of eleven

[3] Not yet imported into the United States but operating in Germany.
[4] Paterson-Mutual Hosiery Mills, Inc.
[5] Huettig, R. C., Hosiery report for 1928 Silk Association.

and twelve are not constant users of full-fashioned hosiery, but many of them do use this product frequently, especially for dress.

The *Statistical Abstract of the United States*[6] has estimated the total population of the continental United States for intra-censal years, giving us figures for 1919 to 1928. In the census of population of 1880, 1890, 1900, 1910 and 1920, the number of females over ten was from 35.9 to 38.2 per cent of the total population, with but little yearly variation. We have assumed in our table that 38 per cent of the intra-censal population of the United States were females over ten.

The *Census of Manufactures* previous to 1927 made no differentiation between seamless hosiery for women, boys, misses and infants. However, the 1927 census separates a total production of 45,918,828 dozen pairs of seamless hose into types, classifying 24,945,998 dozen pairs, or 54 per cent of the total, as women's. Our table is constructed on the idea that in previous censuses a like percentage of the total production of seamless was for the use of women.[7] Separate figures for women's full-fashioned hosiery production have been given by each census for the years considered in Table 10.

Some explanation of our use of production figures as a measure of consumption of hosiery is perhaps necessary. Some slight inaccuracies may enter the computation of per capita use because of this method, if stock on hand at the beginning of a year differs from stock on hand at the end of the year. In other words, production may have been, not for consumption but for stock; and conversely, consump-

[6] Department of Commerce, *Statistical Abstract of the United States*, 1928, page 3.

[7] This assumption seems justified upon analysis of the monthly reports issued by the Department of Commerce. Of reported production of a representative group of firms for the years 1924, 1925, 1926 and 1927, the percentage of women's seamless production shows a close agreement with the 1927 census proportion. In 1926, for instance, the percentage was slightly under 55 per cent, while in 1925 it was just about 54 per cent.

tion may have been from stock on hand and not from production.

The only records available for stock on hand are the monthly Department of Commerce reports, but these data do not help materially because of the impossibility of comparing the figures of the beginning of the year with those of the end of the year; the firms reporting in January may not be identical with the firms reporting in December.

Some measure of the accuracy of our method can, however, be obtained by a comparison of net shipments with production from the Department of Commerce reports. During 1925, of a reported production by the representative group of firms of 9,608,654 dozen pairs of women's full-fashioned hosiery, there were net shipments of 9,814,227 dozen pairs, pointing to a consumption from stock of an amount equal to 2.1 per cent of the year's production. In 1927, the production of full-fashioned hosiery was, for the partial list of firms, 14,908,039 dozen pairs, while shipments were 14,793,695 dozen pairs. Accordingly, it seems that in 1927, .77 per cent of production was not made for consumption but as an addition to stock on hand.

These two years are the only years that can be so checked. Monthly reports are not available for 1919 and 1921, and have not been used in this analysis for 1923.

However, from the tests possible it seems that no great error can occur by using production data in the computation of per capita consumption. Any difference between consumption and production in any one year is likely to be such a small percentage of the total production as to have but little effect on the final results.

While "exports constitute only a small proportion of total production [of hosiery] and reflects the efforts of only a comparatively small group of manufacturers" [8] we should make some allowance for exports of seamless hosiery. The exports of hosiery listed yearly in *Foreign Commerce and*

[8] Department of Commerce, *Commerce Yearbook 1924*, page 321.

*Navigation of the United States*,[9] have been consistently about six million dozen pairs yearly except in 1925, when about seven and one-half million dozen pairs of seamless hose were exported, after making allowance for a small exportation of full-fashioned hosiery. In Table 10, we have assumed that these have been the exports of seamless hosiery.

TABLE 10

PER CAPITA CONSUMPTION OF WOMEN'S HOSIERY IN THE UNITED STATES

1919 to 1927

| Year | Number of Women* | Consumption in Dozen Pairs | | Per Capita Consumption in Pairs | | |
|---|---|---|---|---|---|---|
| | | Seamless | Full-Fashioned | Seamless | Full-Fashioned | Total |
| 1919... | 39,901,164 | 18,354,759 | 6,323,934 | 5.5 | 1.8 | 7.3 |
| 1921... | 41,209,015 | 18,024,960 | 7,589,913 | 5.2 | 2.2 | 7.4 |
| 1923... | 42,443,520 | 19,890,592 | 9,817,996 | 5.6 | 2.8 | 8.4 |
| 1925... | 43,843,675 | 18,045,329 | 12,291,219 | 4.9 | 3.4 | 8.3 |
| 1927... | 45,078,640 | 18,945,998 | 19,771,030 | 5.0 | 5.3 | 10.3 |

* Females over 10 years of age in the continental United States.

Table 10 portrays an increase in per capita consumption of women's hosiery from a little over seven pairs in 1919 to over ten pairs in 1927. This rather large increase, it will be noted, was not shared equally by seamless and full-fashioned.

From 1919 to 1923 the per capita consumption of seamless hosiery showed but little variation, but, when full-fashioned began its increase in 1925, seamless was noticeably affected, its per capita consumption decreasing from 5.6 pairs in 1923 to 4.9 in 1925. Greater use of full-fashioned hosiery, therefore, was responsible for the increased per capita consumption of hosiery in general. From the per capita consumption of a mere 1.8 pairs of full-fashioned in 1919, steady increases were made to 2.2 pairs in 1921 and 2.77 pairs in 1923. Then came the 1925 increase in production with a per capita consumption increase to 3.36 pairs,

[9] Published by the Department of Commerce.

or a gain of .59 pairs in two years. These results agree with our former conclusions pertaining to an increased use of full-fashioned hosiery in 1925 as a result of style changes.

The per capita consumption of full-fashioned hosiery did not fall off in 1927, for that year shows the largest per capita increase recorded; a gain of 1.9 pairs to a total of 5.3. During the same period, from 1925 to 1927, the per capita consumption of seamless remained practically stationary. It is unfortunate that we cannot now carry our study of per capita consumption into 1928. We have already noted that in 1928 the total production of women's seamless hosiery decreased 21 per cent compared to 1927 production.[10] It is therefore quite probable that the per capita consumption of women's seamless hosiery was less than four pairs in 1928, for the population of women increased in that year. Moreover, we have seen that full-fashioned production increased about 15 per cent in 1928 over 1927.[11] We can assume, therefore, that full-fashioned per capita consumption in 1928 was close to six pairs, with seamless at about four pairs. This estimate accords with other conclusions relating to the replacement of women's seamless by fashioned hosiery.

The year 1925, as we have seen, brought a combination of favorable factors for the full-fashioned hosiery industry. In the previous chapter, besides emphasizing the growth of the industry, we advanced certain reasons for the added impetus to its growth in 1925, after its development seemed checked. These reasons seem to be substantiated by our analyses of the material used in full-fashioned hosiery and by our study of per capita consumption. If the 1925 expansion was caused by the style factors already mentioned, then the demand factors were at hand for a continued boom subsequent to 1925. Silk continued to replace the more durable cotton, per capita consumption increased in 1927,

[10] See Table 8 on page 24.
[11] See Table 6 on page 20.

sheerness and light colors remained fashionable, and novelties aplenty were introduced.

Why, then, with such a favorable demand for fashioned hosiery, has increased seasonality appeared in the industry in 1926, 1927 and 1928? Manufacturers of full-fashioned hosiery talk of narrowing margins of profit [12] and of overdevelopment in their industry.

A recent editorial in the *Textile World* stated: "In the early part of 1928, overproduction of women's goods [hosiery], especially full-fashioned, was a serious problem. This created a buyer's market that brought about a price weakness which lasted for a few months. . . . A number of important mills ceased the production of lower end and silk full-fashioned goods and began knitting high grade rayon hose instead." [13]

Certain manufacturers, lacking the equipment needed to manufacture the sheer hosiery in demand, found that they could market their product only by selling it at $1.00 per pair. Costs would not allow a silk stocking to be manufactured at this price. The development of the lusterless rayons, Bemberg, Dulesco and others, aided them materially by making $1.00 full-fashioned hosiery a reality in 1928. The significant point involved is that increased sales were securable only by reduced prices which naturally brought full-fashioned hosiery into competition with the better grades of seamless. Some manufacturers attribute the large decline in the production of seamless hosiery in 1928 to this new development which brought full-fashioned hosiery to a lower price demand.

Furthermore, as spring 1929 prices are announced, the trade has been startled by the price reduction of a leading producer on a five-strand full-fashioned stocking, all silk, with plaited foot and narrow heel, offered at $9.75 a dozen

[12] We recognize that this may be socially desirable, but it presents a real problem of adjustment to the management.

[13] "Hosiery Success to Be Repeated in 1929," February 2, 1929, page 327.

to retailers.[14] Price reductions seem to have occurred in the face of an unusually active demand.

In spite of the increasing demand, therefore, it seems that expansion of productive capacity has outstripped it. This may be very desirable; it may mean that capital is flowing to an industry which is earning profits higher than other lines, and that an adjustment of the capital supply is needed. But to those in the industry it means changed competitive conditions which must be met.

We have already noted that the increases in production after 1925 were accompanied by increasing seasonality, which, in the face of increasing demand, indicates a capacity that is increasing faster than demand. If this were so, not only would greater seasonality occur, but we should expect to find changes taking place within the industry in stock on hand and in unfilled orders.

The monthly reports of production previously used give, for each month, information concerning unfilled orders, cancellations, stock on hand and shipments (as well as production) for firms producing over 60 per cent of the output reported by previous censuses and a greater percentage of current production.[15] As the number of establishments reporting monthly is subject to variation, but still large enough to be typical of the industry, we have studied the meaning of certain of these figures by means of ratio trends. Table 11 lists the ratio of unfilled orders to production, the percentage of unfilled orders represented by cancellations, and ratio of stock on hand to production. Complete details of these items by dozen pairs appear in Appendix A.

A yearly ratio is also computed from the various yearly totals as computed in Appendix A. In 1924 the yearly ratio of unfilled orders to production was about 215, indicating that unfilled orders were on hand for over two months' average production. With the expansion of 1925, this ratio increased to almost 250; about two and one-half months'

[14] Gotham Hosiery Company made this announcement in February 1929.
[15] 78 per cent in 1925 and 75 per cent in 1927.

TABLE 11

RELATION OF UNFILLED ORDERS AND STOCK ON HAND TO PRODUCTION OF FULL-FASHIONED HOSIERY

1924–1928 Monthly

| Year and Month | Percentage of Production | | Percentage of Unfilled Orders |
|---|---|---|---|
| | Unfilled Orders | Stock on Hand | Cancellations |
| *1924* | | | |
| Jan.. | 229.6 | 159.6 | 1.3 |
| Feb. | 216.7 | 154.3 | 2.2 |
| Mar. | 170.8 | 134.8 | 2.4 |
| Apr. | 226.1 | 129.8 | 1.6 |
| May | 191.7 | 123.5 | 1.8 |
| June | 197.4 | 147.4 | 4.2 |
| July | 218.3 | 184.0 | 4.2 |
| Aug. | 247.4 | 205.4 | 1.6 |
| Sept. | 239.7 | 163.3 | .9 |
| Oct. | 187.0 | 117.9 | 1.9 |
| Nov. | 250.3 | 115.9 | 2.1 |
| Dec. | 218.4 | 103.2 | 6.7 |
| Yearly Ratio | 214.9 | 141.7 | 2.6 |
| *1925* | | | |
| Jan. | 230.7 | 105.6 | 3.2 |
| Feb. | 220.5 | 104.4 | 1.2 |
| Mar. | 192.1 | 88.9 | 1.3 |
| Apr. | 244.4 | 81.6 | 1.4 |
| May | 283.9 | 82.5 | .9 |
| June | 299.0 | 85.1 | 2.0 |
| July | 273.6 | 86.3 | 1.4 |
| Aug. | 244.3 | 90.9 | 2.3 |
| Sept. | 224.9 | 90.1 | 1.6 |
| Oct. | 256.8 | 77.9 | 1.6 |
| Nov. | 280.6 | 82.3 | 1.6 |
| Dec. | 222.3 | 76.8 | 5.6 |
| Yearly Ratio | 248.6 | 87.0 | 2.0 |
| *1926* | | | |
| Jan. | 247.0 | 90.0 | 2.7 |
| Feb. | 225.4 | 87.7 | 2.2 |
| Mar. | 220.5 | 76.6 | 1.9 |
| Apr. | 241.8 | 81.2 | 1.4 |
| May | 249.5 | 86.6 | 1.5 |
| June | 242.3 | 88.3 | 3.5 |
| Average | | 84.9* | |
| July | 256.9 | 114.3 | 1.5 |
| Aug. | 205.2 | 114.1 | 6.4 |
| Sept. | 188.3 | 117.4 | 1.5 |
| Oct. | 203.9 | 117.2 | 2.4 |
| Nov. | 209.9 | 118.7 | 2.4 |
| Dec. | 193.2 | 121.2 | 11.3 |
| Yearly Ratio | 222.4 | 117.2 | 3.2 |

* Method of reporting changed after June, 1926.

TABLE 11—*Continued*

| Year and Month | Percentage of Production | | Percentage of Unfilled Orders |
|---|---|---|---|
| | Unfilled Orders | Stock on Hand | Cancellations |
| *1927* | | | |
| Jan. | 189.5 | 140.5 | 2.8 |
| Feb. | 176.0 | 149.4 | 2.9 |
| Mar. | 140.9 | 128.3 | 2.8 |
| Apr. | 155.5 | 166.4 | 2.4 |
| May | 155.0 | 171.3 | 3.4 |
| June | 142.6 | 164.0 | 2.1 |
| July | 176.5 | 220.1 | 2.0 |
| Aug. | 138.9 | 182.9 | 1.2 |
| Sept. | 153.6 | 176.9 | 3.3 |
| Oct. | 152.5 | 161.4 | 2.2 |
| Nov. | 162.4 | 148.4 | 4.0 |
| Dec. | 163.8 | 165.7 | 8.2 |
| Yearly Ratio | 158.0 | 163.6 | 3.1 |
| *1928* | | | |
| Jan. | 169.4 | 174.0 | 2.7 |
| Feb. | 161.2 | 183.7 | 1.3 |
| Mar. | 123.3 | 161.8 | 3.4 |
| Apr. | 122.5 | 181.8 | 3.5 |
| May | 116.2 | 175.0 | 2.9 |
| June | 128.1 | 193.6 | 3.2 |
| July | 149.9 | 240.3 | 1.3 |
| Aug. | 101.5 | 194.3 | 1.5 |
| Sept. | 108.6 | 206.4 | 4.3 |
| Oct. | 91.8 | 161.1 | 2.4 |
| Nov. | 125.8 | 152.8 | 2.6 |
| Dec. | 146.2 | 162.9 | 3.9 |
| Yearly Ratio | 127.4 | 180.4 | 2.7 |
| *1929* | | | |
| Jan. | 129.2 | 158.8 | 1.3 |
| Feb. | 115.1 | 171.6 | 1.9 |
| Mar. | 94.7 | 159.1 | 4.5 |
| Apr. | 99.4 | 162.1 | 5.5 |
| May | 104.8 | 159.9 | 2.6 |
| June | 113.9 | 176.5 | 3.5 |

* Method of reporting changed after June, 1926.

production was represented by unfilled orders. Since that year, the ratio has decreased yearly, slightly in 1926 to over 222; then rapidly in 1927 to 158 and in 1928 to 127. While in 1925 unfilled orders represented about two and one-half months' average production, they were in 1928 only about one and one-fourth times the monthly produc-

tion. Unfilled orders have continued to decrease during the first three months of 1929. The relation of unfilled orders to production can best be understood by a study of Chart II, a presentation of the data of Table 11. The curve indicating ratio of unfilled orders to production is erratic on our chart on account of seasonal variations. As would be consistent with our previous discussion, however, the ratio of unfilled orders to production increased noticeably in 1925. Especially in April, May and June of that year, unfilled orders accumulated, to be gradually lessened by summer delivery of fall merchandise. Then came an increase in orders again, presumably for the Christmas trade. These seasonal trends are much more definite in 1925 than in 1924 which was a poorer year for full-fashioned hosiery manufacturers.

In spite of the continuance of good demand, unfilled orders in 1926 were less than in 1925. To be sure, they were maintained at a high level during the first seven months of the year, but then a steady decline began that lowered the average of unfilled orders to production for 1926 and lasted throughout 1927. Compared to 1925, 1927 kept a much narrower margin between unfilled orders and production, as is shown by its yearly average of 158, a decrease of 36 per cent from 1925. Further decreases of the unfilled order ratio occurred in 1928, in spite of a slight piling up of orders for the fall trade. The ratio of unfilled orders to production for the entire year of 1928 was a decrease of about 48 per cent from the 1925 average. In other words, unfilled orders compared to production decreased almost one-half in 1928 as compared with 1925. Since 1925, we must conclude that production is keeping further ahead of orders or that buyers are ordering closer, following a hand-to-mouth buying policy. Either condition is indicative of a change in the method of conducting the full-fashioned hosiery industry. If a buyer's market has developed, the manufacturers' methods must be adjusted accordingly. If a closer current buying policy is being fol-

lowed, this should be utilized, if good management is to prevail, as a means of eliminating seasonal production.

In order to note whether cancellations have been a compensating factor, the ratio of cancellations to unfilled orders has also been computed in Table 11. Cancellations are a small enough factor to be of little effect. From 1924 to 1928 they ranged on a yearly average from 2 to 3 per cent of unfilled orders. To the extent that they are significant they tend to substantiate the idea that the capacity of the full-fashioned hosiery industry has been growing. The lowest average percentage of cancellations was in 1925; in the following year, when production developed rapidly, they increased to 3.2 per cent. A characteristic of the cancellation curve that is usual in many industries is its tendency to increase greatly in December of each year, except in 1925. Apparently, orders that are actually cancelled are closed from the books as an accumulation in December.

Coincident with the decrease in the ratio of unfilled orders, the ratio of stock on hand at the end of the month to production shows a rapid increase. The growth in the ratio of stock on hand cannot be compared by months since January 1924. A change in the method of reporting stock on hand was made in July 1926. Prior to this date stock on hand included only finished stock; since then it has included not only completely finished stock but also finished stock in the gray; that is, completely knitted but undyed. In July 1926 stock on hand was about 50 per cent of unfilled orders and included about the same number of dozen pairs as the monthly production. In a comparatively few months, by August 1928, stock on hand was about 200 per cent of production and approximately 200 per cent of unfilled orders.

On account of the changed method of reporting in July 1926, but limited conclusions can be drawn from stock on hand figures. We can readily see, however, that in 1924 the average stock on hand represented about one and one-half times the average monthly production, since the ratio

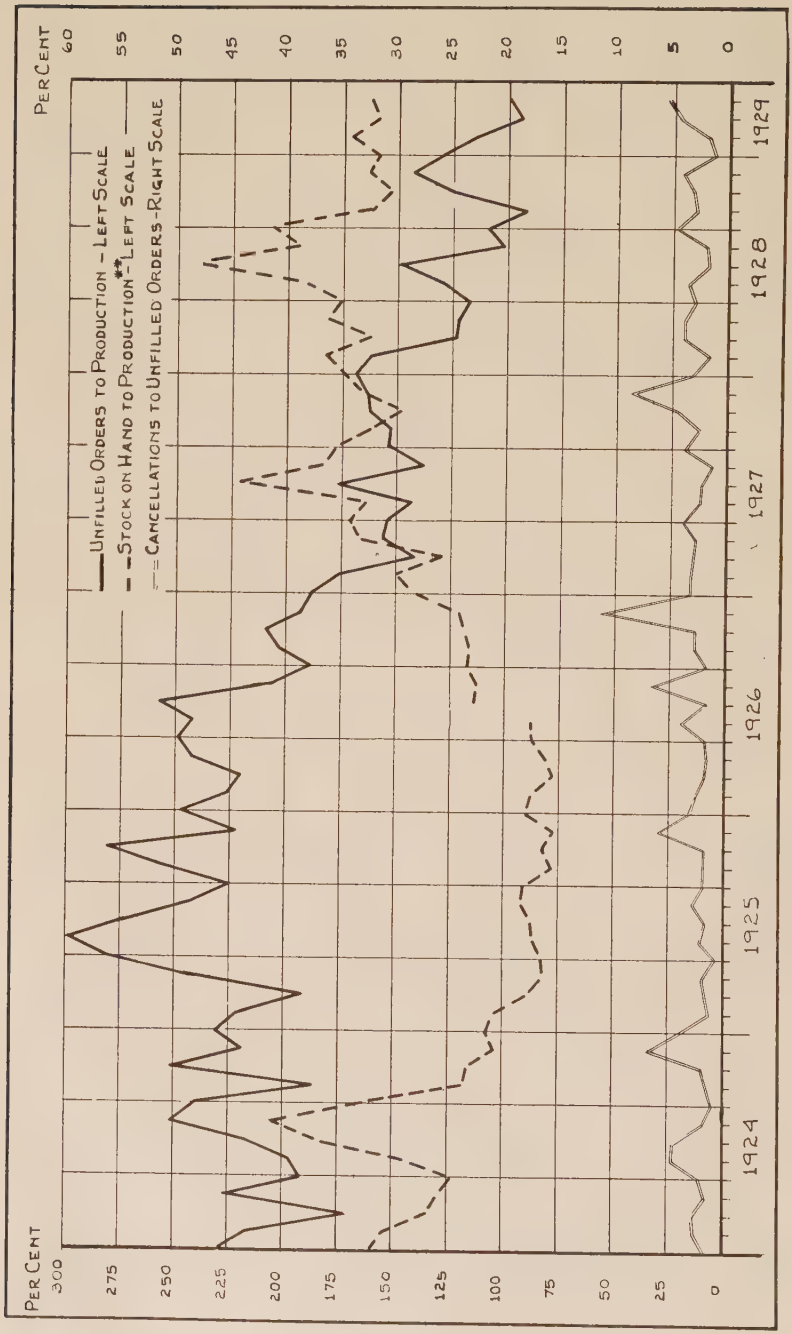


CHART II.* RELATION BETWEEN ORDERS, STOCKS AND PRODUCTION OF FULL-FASHIONED HOSIERY 1924-1929 MONTHLY

* From monthly reports of the United States Department of Commerce.
** Method of reporting changed after June, 1926.

was nearly 142. Depletion of stock on hand began, however, toward the close of 1924 and by 1925 the ratio of stock on hand to production had fallen to about 87, showing that less than one month's production of finished stock was on hand. Manufacturers were not making hosiery for stock in 1925.

The last six months of 1926, when stock on hand included both finished goods and stock in the gray, showed an average ratio of 117, which is somewhat inadequate as a measure for 1926 because of a possible lack of consideration of the fluctuations of earlier months. However, in a sense, this six months' average may be considered typical of 1927 because the stock on hand ratio of 1926 was not subject to any sharp seasonal variations. In 1926, stock on hand was still low. In 1927, however, the ratio was nearly 164, and in 1928 it was 180, showing an increased percentage of production remaining in stock in 1928 over 1927, and in 1927 over 1926. In the data of stock on hand we have still another evidence of a changing management problem in the industry. Increasing production was going more largely into stock. Even if this increase were predicated upon hand-to-mouth buying and more styles, it is indicative of a problem that the alert manager would have to face in the conduct of his business.

It is to be expected that changes should occur within an industry as it develops. It may be that the changes occurring in the full-fashioned hosiery industry are socially desirable; but the changes should be recognized by the management for the proper direction of the industry.

Prospects appear certain for a continued increase in the productive capacity of the full-fashioned hosiery industry. In 1928, construction was started on 22 new hosiery mills,[16] while enlargements and improvements were begun by 32 concerns.[17] At present there are close to 12,000 full-fash-

[16] *Textile World*, February 2, 1929, page 447. This number includes old establishments that erected new mills, in addition to mills erected by new concerns.

[17] *Ibid.*, page 449.

ioned knitting machines in operation in the United States.[18] To these, there are being added approximately 1,700 machines per year,[19] which are built of a greater number of sections,[20] and which run a greater number of courses per minute.[21] Must we, then, expect the full-fashioned hosiery industry to increase its output about 15 per cent yearly, that is, to increase more rapidly than practically any other industry in the United States increased from 1919 to 1926? [22] How will this increased production be consumed?

A very marked increase of full-fashioned consumption could undoubtedly be secured by further inroads into the seamless field. There is still more women's seamless hosiery manufactured in the United States than full-fashioned. In 1927 the *Census of Manufactures,* for the first time, gives a figure for women's seamless hosiery production. It is surprising to note that the seamless output was 24,945,998 dozen pairs in contrast to the women's full-fashioned hosiery production of 19,771,030 dozen pairs. But, the smaller amount of full-fashioned hosiery is valued at $227,414,977 or at an average value of $11.50 a dozen pairs, while the seamless has a value of but $86,897,040 or $3.48 per dozen pairs. Perhaps the field for full-fashioned hosiery is but barely scratched. Perhaps seamless hose can be still further displaced. However, so far apart are the values of full-fashioned and seamless hosiery that it seems that small price reductions of full-fashioned hosiery will result in but a small shifting of demand from seamless to full-fashioned. It is problematic just how large a portion of the seamless market can be won to full-fashioned by, say, a 10 per cent price reduction. An article valued at $11.50, however, will

[18] See page 91.

[19] See page 60.

[20] The older machines are mainly of 18 sections for leggers and 18 and 20 sections for footers. Newer machines consist of 24-sectioned leggers while some footers have 28 and 30 sections.

[21] Most of the currently-produced machines can attain an average speed of 58 to 60 courses per minute; older equipment runs as low as 40 courses per minute.

[22] See page 14.

enter a large part of a market now buying $3.50 merchandise only if prices are reduced rather substantially, or unless purchasing power in the country increases greatly. Certainly, lowered prices will make of the full-fashioned hosiery industry a different industry, particularly if a reduced income is not compensated for by better management. If production continues to grow, this growth may lead to decreased prices to get into the seamless market.

A possible outlet for increased full-fashioned production may lie in the export field. However, there seems to be some question of the possibility of exporting full-fashioned hosiery at prevalent prices. Other countries lack the resources to absorb an article of luxury, and it seems possible that a large development of exports would also necessitate a price decrease unless trading could be developed with a country where the comparative advantages of trade would be great enough to allow hosiery exports at present prices.

Further increases in the per capita consumption at the present price level, an increase in schedule demand, might possibly absorb a greater production of full-fashioned hosiery without a price decrease. The per capita consumption of full-fashioned, as we have seen, increased as the result of style changes to silk, sheerness and color. It is unlikely that any further factors will lead to such a large increase in per capita consumption. Full-fashioned hosiery is already on a millinery basis, with numerous styles. It can hardly become sheerer, nor can the color advantage be further used. On the other hand, some apprehension is being expressed over the bare leg fad, which, it is feared, may decrease the per capita consumption of full-fashioned hosiery, and some concern has been voiced over the possibility of the return of darker colors to favor. Already, gun metal and light gun metal have caused some worry that has been, for the time being, dispelled by the present demand for the various sun tan colors. It is difficult to say just what a revival of long skirts would do to this industry that expanded so rapidly under the impetus of short skirt styles. On the other hand,

some recent developments show tendencies toward improvements designed to increase the life of a pair of stockings and hence to decrease per capita consumption. We have in mind the numerous machines [23] installed in hosiery shops to repair runs in stockings, which are thereby made useful again and are not discarded. More recently an innovation termed "silk sealing" has been announced.[24] A special process makes the silk fibres in the hosiery stainless and spotless. Undoubtedly this will increase the life of a pair of stockings. Further large increases in per capita consumption in the United States seem doubtful.

What, then, is the prospect? It seems that increased production must result in still further lowering of prices with consequent changes in the hosiery business, either in reduced shares to the factors of production or in lowered costs through better management. Any possibility of a maintenance of the status quo with regard to both prices and the present organization of distributive shares must rest upon a limiting of production. Is there a possibility that something will check the rapid expansion of production in the industry? One limiting factor may be the obsolescence of some of the older machine equipment.

The very change in style which caused the industry to expand is decreasing the usefulness of much of the older equipment. Sheerness, picot edges, fancy heels—all are needed to meet the style demand. If there is an increasing overproduction of full-fashioned hosiery, it may be an overproduction of stockings made on the older machines which knit a comparatively coarse fabric and which lack attachments. In addition to their lack of ability to meet style, they may lack speed. We see here what Mazur had in mind when he wrote, "Wear alone made replacement too slow for the needs of American Industry. . . . Obsolescence was made supreme, and . . . the danger of saturation could be removed beyond the stars. If what had filled

[23] The Knitbac, Vanitas, Stelos and other machines are now in operation for repairing hosiery runs.

[24] By the Dexdale Hosiery Mills of Lansdale, Pa.

the consumer market yesterday could only be made obsolete to-day, that whole market would be again available to-morrow." [25] It is not, says Mazur, that this destructive obsolescence has never been a factor in business, but in the last few years in the United States it has been developed to an exceedingly high degree. It may be felt in the full-fashioned hosiery industry.

It is our plan to study the possibility that obsolescence will become a preventive of overdevelopment of the full-fashioned hosiery industry. It is our intention to note, first, the factors responsible for the increased output of full-fashioned hosiery, and then to consider the change in the type of knitting machine produced and imported as the industry developed. This latter consideration will consist mainly of a study of gauges, for they determine sheerness. Our next step will be to study the amount of machinery which entered the industry over a period of years and to present a census of the type of machinery now in operation in the United States.

[25] Mazur, Paul, *American Prosperity—Its Cause and Consequences*, pages 92 and 93.

# CHAPTER IV

## EQUIPMENT TRENDS IN THE FULL-FASHIONED HOSIERY INDUSTRY

Before considering the question of obsolescence of equipment, we shall first discuss the increases in equipment that have made greater production of full-fashioned hosiery possible. Has the equipment of the industry increased at a faster rate than the production of hosiery? Is this increase in equipment responsible for the greater measure of seasonality in 1928 as compared to 1925? Has increased output been made possible by newer methods of operation? Has the increase of capacity been accomplished in an orderly manner, with a mind to correlating capacity with demand?

One measure of the increase in productive equipment is available in the number of mills manufacturing full-fashioned hosiery each year. While this measure may not be accurate in stating the actual growth in productive equipment, it does afford a picture of the influx of new mill equipment into the industry. We cannot urge that the new mills represent a very small capacity because of the small number of machines initially installed; new factories grow rapidly in the full-fashioned industry, and often begin operations on a large scale.[1]

It is significant that the number of mills listed in a leading trade directory as manufacturing women's full-fashioned hosiery increased from 92 in 1919 to 235 by July 1928,[2] while additions since then have made the total 263 by March 1929. Table 12 gives the number of mills manu-

[1] One factory at Reading has grown from 18 machines in 1924 to over 300 at the present time, while a newly-organized factory in North Carolina is erecting a building to house approximately 100 machines.

[2] Davison's Knit Goods Trade—1919 to 1925.

facturing women's full-fashioned hosiery listed each year since 1919.

TABLE 12

MILLS MANUFACTURING WOMEN'S FULL-FASHIONED HOSIERY IN THE UNITED STATES

1919 to 1929

(Also classified by leading districts)

| Year | Total | Relative Growth 1919 as 100 | Pennsylvania | | South* | | Middle† West | | New Jersey | | New York | | All Others | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent |
| 1919 | 92 | 100. | 41 | 44.6 | 17 | 18.5 | 8 | 8.7 | 6 | 6.5 | 8 | 8.7 | 12 | 13. |
| 1920 | 105 | 114.1 | 44 | 41.9 | 21 | 20. | 11 | 10.5 | 8 | 7.6 | 11 | 10.5 | 10 | 9.5 |
| 1921 | 132 | 143.5 | 62 | 47.0 | 23 | 17.4 | 10 | 7.6 | 9 | 6.8 | 13 | 9.8 | 15 | 11.4 |
| 1922 | 146 | 158.7 | 71 | 48.6 | 13 | 8.9 | 10 | 6.9 | 14 | 9.6 | 18 | 12.3 | 20 | 13.7 |
| 1923 | 163 | 177.2 | 81 | 49.7 | 15 | 9.2 | 14 | 8.6 | 17 | 10.4 | 17 | 10.4 | 19 | 11.9 |
| 1924 | 152 | 165.2 | 84 | 55.3 | 12 | 7.9 | 13 | 8.6 | 14 | 9.2 | 11 | 7.2 | 18 | 11.8 |
| 1925 | 156 | 169.6 | 83 | 53.2 | 15 | 9.6 | 14 | 9.0 | 17 | 10.9 | 10 | 6.4 | 17 | 10.9 |
| 1926 | 178 | 193.5 | 99 | 55.6 | 14 | 7.9 | 16 | 9.0 | 19 | 10.7 | 12 | 6.7 | 18 | 10.1 |
| 1927 | 208 | 226.1 | 114 | 54.8 | 22 | 10.6 | 16 | 7.7 | 18 | 8.7 | 13 | 6.3 | 25 | 17.9 |
| 1928 | 235 | 255.4 | 126 | 53.6 | 29 | 12.3 | 17 | 7.2 | 23 | 9.8 | 15 | 6.4 | 25 | 10.7 |
| 1929 | 263 | 285.9 | 147 | 55.9 | 41 | 15.6 | 19 | 7.2 | 28 | 10.6 | 11 | 4.2 | 17 | 6.5 |

* Alabama, Georgia, North Carolina, South Carolina, Tennessee, Kentucky, Virginia, Louisiana, Texas are southern states having full-fashioned mills. North Carolina is the leading southern center.
† Illinois, Minnesota, Wisconsin, Iowa, Michigan.

TABLE 13

MILLS MANUFACTURING WOMEN'S FULL-FASHIONED HOSIERY IN PHILADELPHIA

1919 to 1929

| Year | Number | Per Cent of Total |
|---|---|---|
| 1919 | 28 | 30.4 |
| 1920 | 30 | 28.6 |
| 1921 | 42 | 31.8 |
| 1922 | 50 | 34.2 |
| 1923 | 58 | 35.6 |
| 1924 | 56 | 36.8 |
| 1925 | 62 | 39.7 |
| 1926 | 68 | 38.2 |
| 1927 | 72 | 34.6 |
| 1928 | 77 | 32.8 |
| 1929 | 83 | 31.6 |

This table showing the number of mills manufacturing full-fashioned hosiery each year substantiates the general conclusions reached so far. Growth in numbers of mills was rapid and fairly constant from 1919 to 1921. Even the 1920-21 depression failed to prevent the appearance of ad-

ditional new mills. It should be kept in mind that the numbers of mills listed are those operating as of the middle of each year. Accordingly 1924 and 1925 show a decrease in the number of mills as compared with 1923, as a result of generally poor business in 1924.

The 1925 boom began, as we have seen,[3] in June. Its effect on new mill operation is found in the 1926 increase in mills to 178 from 155 in the previous year. Since 1926, increases have continued until, by early in 1929, 263 mills produced women's full-fashioned hosiery.

From 1919 to 1925, the number of mills had increased nearly 70 per cent, while from 1925 to the early months of 1929, the increase was 68.5 per cent. In other words, the number of full-fashioned mills has increased rapidly, particularly since 1924, when it was thought that production was approaching a saturation point.

It is of interest, incidentally, to note from Table 12 the extent of the localization of the full-fashioned industry in Pennsylvania. From 1919 to 1926, the percentage of total mills located in Pennsylvania increased from about 45 per cent to 55.6 per cent, the latter proportion being maintained until the present.

Table 13 shows that, in 1925, 40 per cent of all full-fashioned mills were located in Philadelphia. Although this city had a larger number of mills by 1929, they represented but about 31 per cent of the total number of mills in the industry. Philadelphia is losing some measure of her dominance of this industry as far as percentage of the total number of mills is concerned.

The communities that are increasing their proportionate share of the full-fashioned mills are numerous. In Texas the first full-fashioned hosiery mill to begin business in that state is now on a production basis; California and Utah both boast of newly-established full-fashioned mills, while New Jersey's percentage of the total mills increased somewhat

[3] Chart I on page 25.

in the last three years. However, the fastest-growing area is the south in general, and North Carolina in particular. The south had lost a number of its full-fashioned hosiery mills in the years from 1922 to 1926. In 1927 and 1928, however, the full-fashioned establishments in this district increased in number, the 1928 total being a relatively large increase over 1927. Of the 41 full-fashioned hosiery mills located in the south in 1929, 25 were in North Carolina.

The various reasons advanced for the increasing percentage of mills in the south, especially for the accelerated movement in 1928, and for the movement of mills to suburban areas in Pennsylvania [4] are pertinent to our discussion. Certain northern manufacturers assert that they are unable to operate profitably under union regulations as long as they must compete with plants operating on a non-union basis. This claim is based upon the comparatively high wage rates of the knitters of the full-fashioned industry.[5] A recent survey of industrial conditions in North Carolina offers as an inducement for northern mill owners to move to that state, "There is absolutely no unionism in the mills in this area, nor have the unionists ever been able to get any kind of foothold in this part of the South." [6] The report claims a labor cost of manufacturing a dozen pairs of full-fashioned hosiery of $1.17 a dozen in North Carolina as compared to $2.18 in Philadelphia and $1.69 in Reading. The significance of these conditions seems to be that competition is becoming more pronounced in the industry and the saving of a few cents per stocking in the cost of production is of real importance now. At any rate, many new plants are beginning operations in non-union centers.

The number of mills in the Reading area has always been

[4] Philadelphia is losing some of her share of total mills, but Pennsylvania has retained her proportionate advantage.

[5] A study made in October 1927 by the Bureau of Labor Statistics and issued as Bulletin #452 gives on page 5 an average hourly earned rate in the United States of $1.511 for footers and $1.286 for leggers and average weekly full time earnings of $77.06 and $65.70, respectively.

[6] Charlotte, N. C., Industrial Bureau, June 1, 1928.

a relatively small percentage of the industry's total. The importance of these mills is, however, much greater than their number would imply, since Reading's mills include what is probably the largest full-fashioned hosiery mill in the world, and another rapidly-growing factory that even now ranks with the leading producers.

It is surely the demand for more hosiery that has called into being so many new mills, which in turn have made increased production possible. However, a consideration of only the growth in number of mills affords no evidence of an equipment increasing faster than production. Machines turn out stockings; mills house a varying number of machines. Hence our discussion of increasing equipment must be concerned with the number of machines utilized in these mills.

The best measure of the growth of the productive equipment of the full-fashioned hosiery industry would be found in a record of the number of machines in operation in all mills yearly since 1919. It is obviously impossible to secure such data. Many of the mills operating several years ago are not now in existence; others have been re-organized or merged. Still other mills have no record of the date of acquisition and disposal of their equipment, so that it is impossible to trace the growth of the equipment of each plant.

However, data can be secured from the domestic producers and from the importers of full-fashioned hosiery machinery of their yearly placement of machines in the full-fashioned hosiery plants of the United States. Such data give a measure of the yearly increment to productive capacity, although they do not show conclusively the percentage of yearly addition to total equipment. No complete record of machinery scrapped or sold by the hosiery manufacturer can be secured. However, such disposal of machinery by the manufacturer has apparently been but a very small percentage of the total equipment entering the industry. About 13,000 knitting machines have been placed in the full-fash-

ioned hosiery industry since 1902.[7] From the census of machines in operation as of March 1929,[8] a record has been secured of 11,904 of these machines that are still in operation. But a small number of machines produced since 1902, therefore, have been withdrawn from the industry. The profitable life of a knitting machine has been estimated to be in the neighborhood of fifteen years, although we have seen one 25-year old machine still operating on a productive basis. One reason for the relatively long useful life of full-fashioned hosiery machinery may be that even the newest machinery is constructed on no radically different principles of operation from those of the older equipment. Improvements have been made chiefly in the nature of attachments for producing novelty hosiery and of the addition of higher-geared drives to increase the possible number of courses per minute. We therefore feel that, since such a small percentage of the knitting machinery produced in the twentieth century has been disposed of, a statement of the yearly production and importation of knitting machinery affords an accurate picture of the nature and rate of the industry's increase of equipment.

In Table 14 the yearly production and importation of full-fashioned knitting machines from 1919 to 1928 has been listed. The total production from 1902 to 1918 has been grouped into one figure, since this study is concerned mainly with trends since 1919. The present table is based upon the number of full-fashioned hosiery machines produced and imported by all of the leading firms. Data of the importation of the German Richter, Einseidel and Boessnecht machines are not available, but these makes were never an important proportion of the industry's equipment.

The machinery production and importation figures throw much light upon the factors responsible for the large growth

[7] Our records show the detail of 12,565 machines. While these include both domestic production and importation, frequent reference to production on subsequent pages will be understood to refer to the total of both production and importation.

[8] See page 91.

TABLE 14

PRODUCTION AND IMPORTATION OF FULL-FASHIONED HOSIERY KNITTING MACHINES IN THE UNITED STATES

1902–1928

| Year | Yearly* Production and Importation | Yearly Relative | Cumulative Totals | Total Equipment Relative | Per Cent of Cumulative Totals Added Yearly |
|---|---|---|---|---|---|
| 1902–1918..... | 2,078 | | 2,078 | | |
| 1919..... | 300 | 100 | 2,378† | 100 | 12.6 |
| 1920..... | 593‡ | 197.7 | 2,971 | 124.9 | 20.0 |
| 1921..... | 789 | 263.0 | 3,760 | 158.1 | 21.0 |
| 1922..... | 1,032 | 344.0 | 4,792 | 201.5 | 21.5 |
| 1923..... | 678 | 226.0 | 5,470 | 230.0 | 12.4 |
| 1924..... | 471 | 157.0 | 5,941 | 249.8 | 7.9 |
| 1925..... | 1,139 | 379.7 | 7,080 | 297.7 | 16.1 |
| 1926..... | 2,134 | 711.3 | 9,214 | 387.5 | 23.2 |
| 1927..... | 1,731 | 577.0 | 10,945 | 460.3 | 15.8 |
| 1928..... | 1,620 | 540.0 | 12,565 | 528.4 | 12.9 |
| Total production..... | 12,565 | | | | |

* This column represents yearly production and importation except for the first figure, which is the total from 1902 to 1918 inclusive.

† Our total production at the close of 1919 can be compared with census data. The 1919 *Census of Manufactures* lists 2,767 full-fashioned, flat, spring needle machines engaged in the manufacture of hosiery. Since we have a record of 2,378 machines in use in 1919, the difference of 389 machines may be accounted for by the fact that our records do not include importations of David Richter, Einseidel or Boessnecht machines.

‡ 1920 was the first post-war year in which imports of machines were made.

of the production of full-fashioned hosiery. Considering 1919 production as a base, the yearly output of knitting machinery increased at a much greater rate than either the production of hosiery or the number of mills. It appears that the yearly construction of machines is a more sensitive barometer of conditions in the full-fashioned industry than either hosiery production or number of mills. Good business results in increased orders for machinery; when times are less prosperous, machinery demand quickly decreases, as in 1924. At the same time the production of hosiery may be expected to show a more steady yearly increase because of the cumulative effect of using a greater number of machines.

The annual output of knitting machinery grew steadily from 1919 to 1922, increasing from a relative base of 100 in 1919 to 344 in 1922. The 1920-21 depression failed to

slow up the demand for hosiery machinery. However, during the uncertain years of 1923 and 1924 when the fear of overproduction was frequently voiced, the yearly output of knitting machinery declined. But even in these dull years a substantial increase of machinery was made.

Then came the rebound in 1925. The extraordinarily large business of that year led to an unprecedented demand for full-fashioned hosiery machinery that became effective in increasing machine construction in 1926. In that year 2,134 new machines entered the industry from the machinery firms reported. These increased the equipment 23 per cent in one year through a production and importation that was over seven times as large as the 1919 output. However, by the time that the 1926 machines entered the field, the greatest expansion of production had already occurred and the new machines began to have a more noticeable seasonal usage.[9] While the rate of increase of machinery attained in 1926 was not maintained during 1927 and 1928, enough knitting machines were produced and imported in those years to be considerably over five times the 1919 production.

Table 14 includes in addition to the yearly production of machines, a statement of the cumulative total number of machines placed into the industry by the end of each year, and the percentage of the cumulative total represented by each year's production of machinery. This information gives some idea of the rate of increase of machine equipment. From 1920 to 1922, the industry was increasing its number of machines at the rate of about one-fifth of the cumulative total each year. With the 1923 and 1924 dullness, this rate decreased, being about 8 per cent in 1924. Although a high rate of increase was attained again in 1925, in 1926 the full-fashioned hosiery industry absorbed a number of machines equal to about 23 per cent of the total in existence. Since then the yearly rate of absorption of equipment has been lower though still very substantial.

[9] Chart I on page 25.

Of even more significance is the increase in cumulative totals of machines. The 1925 production of hosiery was made by all the equipment produced before 1925 and still in use. Considering as 100 the total production of the years previous to 1920, we note from Table 14 that by 1925 the number of machines had trebled, and by 1928 had increased to over 500 per cent of the 1919 total. From 1919 to 1925 the production of full-fashioned hosiery was doubled, while the 1928 output was 350 per cent of the 1919 production. Despite a large demand for full-fashioned hosiery, the total machine equipment increased at a faster rate than the hosiery output, which was inevitably characterized by seasonality.

We have already seen that since 1925, in spite of a large demand for full-fashioned hosiery, a tendency to less favorable conditions in the industry was apparent. At least a partial cause of the decreasing unfilled orders, the increasing stock on hand, and falling prices of full-fashioned hosiery since 1920 has been the increase of equipment at an even greater rate than the yearly production and consumption of full-fashioned hosiery. The natural result has been not only an increasing stock on hand, but growing seasonality that is yearly becoming more marked. It appears, then, that more equipment is not giving proportionate increases in production, but is giving greater capacity usable only to fill seasonal orders.

The increase in the productive equipment has been more accurately measured by the additions of machinery than by the increase in the number of mills. Even this measure, however, is somewhat inaccurate. Machines have a varying number of sections, and, if the trend has been to the construction of machines of a greater number of sections,[10] then productive capacity will have increased to a greater extent than is indicated by the increase in numbers of machines. Accordingly, in Table 15 we have compiled the yearly output

[10] This seems probable since most of the newly-produced machines are of 24 and 28 sections.

and importation of sections, using the sections of the machines reported in Table 14 as a basis for the table.

TABLE 15

PRODUCTION AND IMPORTATION OF FULL-FASHIONED HOSIERY KNITTING MACHINE SECTIONS IN THE UNITED STATES

1902–1928

| Year | Yearly Production and Importation | Yearly Relative | Cumulative Sections | Cumulative Sections Relative | Per Cent of Cumulative Sections Added Yearly |
|---|---|---|---|---|---|
| 1902–1918..... | 38,235 | | 38,235 | | |
| 1919..... | 5,536 | 100 | 43,771 | 100 | 12.6 |
| 1920..... | 11,000 | 198.7 | 54,771 | 125.1 | 20.1 |
| 1921..... | 14,670 | 265.0 | 69,441 | 158.7 | 21.1 |
| 1922..... | 19,292 | 348.5 | 88,733 | 202.7 | 21.7 |
| 1923..... | 12,806 | 231.3 | 101,539 | 232.0 | 12.6 |
| 1924..... | 8,972 | 162.1 | 110,511 | 252.5 | 8.1 |
| 1925..... | 22,084 | 398.9 | 132,595 | 302.9 | 16.7 |
| 1926..... | 43,348 | 783.0 | 175,943 | 402.0 | 24.6 |
| 1927..... | 37,178 | 671.6 | 213,121 | 486.9 | 17.4 |
| 1928..... | 35,872 | 648.0 | 248,993 | 568.9 | 14.4 |

Considering the number of sections produced in 1919 as 100, the yearly production of sections has increased at a faster rate than machine production. Especially in 1926, 1927 and 1928 is there evidence, from Table 15, of a growing trend to machines of a greater number of sections. In 1927 the production of sections was almost 6¾ times the number produced in 1919, while in the same year the output of machinery was less than six times the 1919 output. In 1928, the relative index of the yearly output of sections was nearly 650 compared to 540 for machinery.

In comparing section output with machine output, we see that, from 1919 to 1924, there was a comparative stability in the number of sections per machine produced. Since then, however, the more rapid increase in the production of sections than of machines implies a trend to the use of more sections per machine. Further, a comparison of the section with the machine as the productive unit in this industry shows that the percentage of total cumulative equipment added

yearly differs greatly only in the later years. This too is due to the use of a greater number of sections per machine.

Of real significance is the computation showing the relative cumulative increase in sections entering the industry. Considering the total machines produced from 1902 to 1919 inclusive as 100, the total number of sections made available by the end of 1928 was over 5½ times greater. From 1919 to 1928 the production of hosiery increased 250 per cent, but the total number of sections producing hosiery increased over 400 per cent. To be sure, some allowance must be made for scrapping of machinery, although we have already noted that scrapping was negligible. The tendency toward the addition of equipment at a rate so fast as to preclude full-time operation is clear.

The fact that there has been a trend to the use of more sections per machine is important. Not only does it mean that productive equipment is increasing at a faster rate than the output of machinery would indicate, but it suggests the possibility that the machines of relatively few sections may find it more difficult to compete with the newer models. In order more adequately to study this important trend in the number of sections per machine, Table 16 has been constructed. It shows the percentage of total yearly production of machines classified by the number of sections, from 1919 to 1928.

It will be noted from this table that 18-section machines dominated previous to 1925. Machines with fewer than 18 sections were built before 1925, and have been built since then, especially in the development of finer gauge machines. Machines of less than 18 sections, however, have never been a very important group. By 1925, the 20-section machine was a more important factor in yearly production than the 18-section type, the production of which was virtually eliminated by 1928. But the 20-section machine, in turn, is being supplanted by the 24-section type, which became a large percentage of the total production in 1927 and the most important type produced in 1928. Moreover, 28-section machines,

## TABLE 16

### Yearly Output of Machines Classified by Number of Sections Per Machine

1919–1928

| Year | Sections Per Machine | | | | | | | | | | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Below 18 | | 18 | | 20 | | 22 | | 24 | | 26 | | 28 | | 30 | | | |
| | Number of Machines | Per Cent of Total | Number of Machines | Per Cent of Total | Number of Machines | Per Cent of Total | Number of Machines | Per Cent of Total | Number of Machines | Per Cent of Total | Number of Machines | Per Cent of Total | Number of Machines | Per Cent of Total | Number of Machines | Per Cent of Total | Number of Machines | Per Cent of Total |
| 1919... | | | 232 | 77.3 | 68 | 22.7 | | | | | | | | | | | 300 | 100.0 |
| 1920... | | | 432 | 72.9 | 160 | 27.0 | | | 1 | 0.1 | | | | | | | 593 | 100.0 |
| 1921... | 4 | 0.5 | 513 | 65.1 | 270 | 34.1 | | | 2 | 0.3 | | | | | | | 789 | 100.0 |
| 1922... | 2 | 0.2 | 676 | 65.5 | 345 | 33.4 | 9 | 0.9 | | | | | | | | | 1,032 | 100.0 |
| 1923... | | | 408 | 60.2 | 254 | 37.5 | 1 | 0.1 | 15 | 2.2 | | | | | | | 678 | 100.0 |
| 1924... | 4 | 0.9 | 270 | 57.3 | 170 | 36.1 | | | 27 | 5.7 | | | | | | | 471 | 100.0 |
| 1925... | | | 455 | 40.0 | 632 | 55.5 | 1 | 0.1 | 49 | 4.2 | | | 2 | 0.2 | | | 1,139 | 100.0 |
| 1926... | 21 | 1.0 | 267 | 12.5 | 1539 | 72.1 | 4 | 0.2 | 274 | 12.8 | | | 29 | 1.4 | | | 2,134 | 100.0 |
| 1927... | 18 | 1.0 | 71 | 4.1 | 978 | 56.5 | 10 | 0.6 | 601 | 34.7 | 5 | 0.3 | 48 | 2.8 | | | 1,731 | 100.0 |
| 1928... | 13 | 0.8 | 30 | 1.9 | 679 | 41.9 | 30 | 1.9 | 799 | 49.3 | | | 68 | 4.2 | 1 | * | 1,620 | 100.0 |

*Less than 1/10 of 1 per cent.

first produced in 1925, are becoming increasingly important, while in 1928 a 30-section machine was built.

The trend to the construction of machines with a greater number of sections per machine is so definite, and has been so revolutionary, that we have prepared Chart III to show the trend graphically. The curves on this chart are developed from the material of Table 16; hence, they show the percentages of each year's production supplied by each group of machines, the classification being by the number of sections per machine.

Chart III emphasizes the trend to a greater number of sections per machine. In 1919, 77.3 per cent of the machines produced were of 18 sections each. From 1919 to 1922, a little change towards more sections per machine took place; but from 1923 to 1926 the trend was definitely a replacement of 18-section machines by the 20-section type (except for a slight decrease in the output of 20-section machines in 1924). In 1926, 18-section machines constituted only 12.5 per cent of the year's production, while the 20-section machines made up the bulk of the output—72.1 per cent of all machines produced that year. In 1927 a majority of the machines produced were still the 20-section type. However, following the first sizeable production of 24-section machines in 1923, this type of machine has assumed a place of importance in the total production, of primary importance in 1928. 1927 and 1928 were characterized by an increased use of 24-section as well as of 28-section equipment. In 1928 the 24-section machine comprised over 49 per cent of the year's output, as compared with only 4.2 per cent in 1925. Moreover, 18-section machines constituted a mere 1.9 per cent of the total output in 1928, while in 1919 they had supplied almost 80 per cent of total machinery produced in the year.

The 18-section machine has been quickly replaced by the 20-section model, which is in turn losing much of its importance to the 24-section machine. Moreover machines with even more sections are being increasingly used.

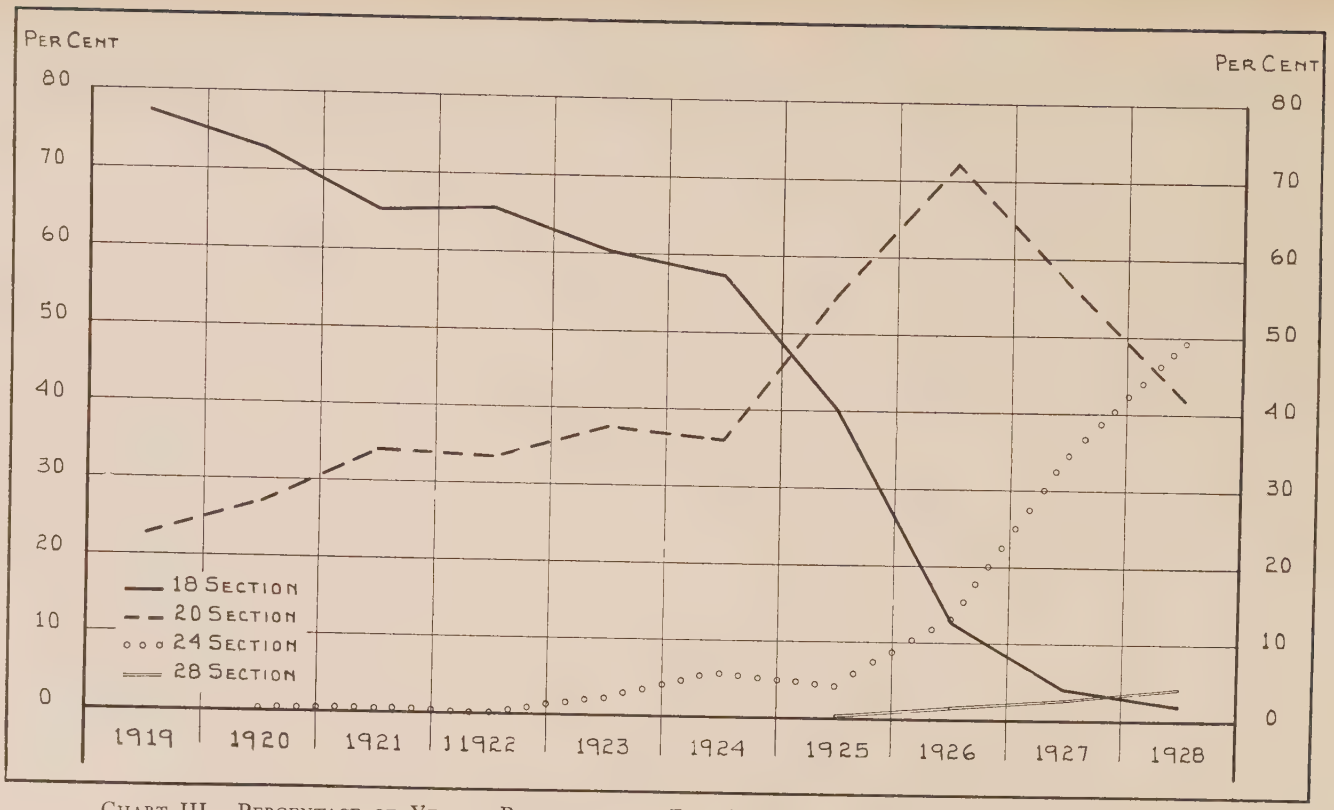


CHART III. PERCENTAGE OF YEARLY PRODUCTION OF FULL-FASHIONED HOSIERY KNITTING MACHINES BY SECTIONS PER MACHINE 1919-1928

We can safely say that, especially beginning with 1925, there has been a trend towards the production of the full-fashioned hosiery machine of a greater number of sections. It may be that the rising 24-section machine will be replaced by 28- or 30-section machines. Some manufacturers maintain, however, that 28- and 30-section machines, and even the 24-section types are less productive than the 18- or 20-section machine. They argue that when one section stops a greater amount of equipment is idle. A study should be made to test the validity of this contention. The industry is undoubtedly increasing its use of machines consisting of a larger number of sections and should act upon an accurate knowledge of the probable results.

In passing it may be noted that the use of the 28- or 30-section machine may be retarded because of the special factory construction that is necessary in order properly to house such lengthy machines, as well as to provide the solid foundation necessary for proper alignment of the long frames.

This definite trend in the use of a greater number of sections is important not only because of the increased capacity per machine that it implies but because of the possible obsolescence of the machines having only 18 sections. This type of machine has certainly lost favor in a comparatively short space of time.

We have shown that the capacity of the full-fashioned hosiery industry as measured by number of sections has increased faster than the output of machines would indicate. In order more clearly to relate the increasing output of hosiery with the increasing equipment of the industry, Chart IV has been drawn.

The foregoing chart has been constructed from the bi-yearly indices of hosiery production developed in Table 2 [11] and from the data of the production and importation of sections in Table 15.[12]

[11] See page 12.
[12] See page 63.

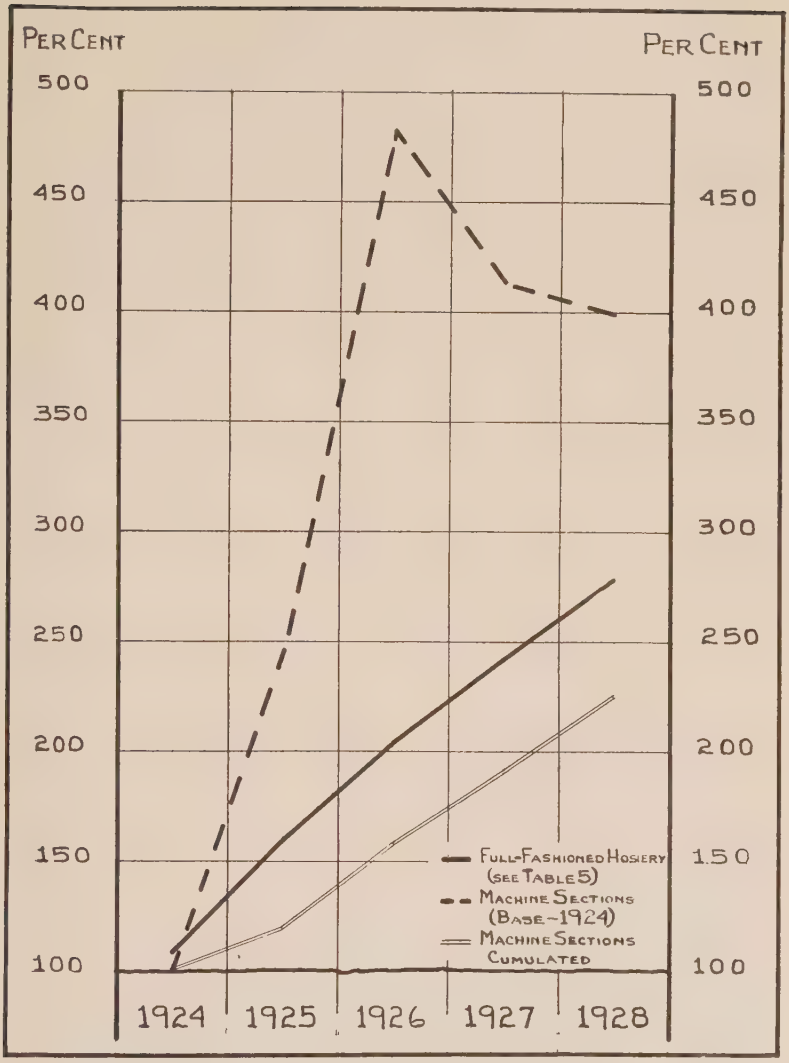


CHART IV. INDICES OF PRODUCTION OF FULL-FASHIONED HOSIERY AND OF MACHINE SECTIONS 1924-1928

The curve representing cumulative section production is of importance because each year's production of hosiery is knit by the total machines produced in all previous years and still in use. Since 1924, the cumulative production of sections has increased at about, or below, the rate of increase of full-fashioned hosiery production. This was not true of earlier years. An analysis of Tables 2 and 15 reveals that from 1919 to 1923, total sections produced increased 132 per cent, while full-fashioned hosiery production increased but 55 per cent. In 1920, 1921 and 1922, the yearly addition of sections was, in each year, an increment of over 20 per cent of total equipment then in use. Although the next two years witnessed a much slower rate of growth, the "overdevelopment" of which hosiery manufacturers spoke, in 1923 and in 1924, seems to have been very real. Machine construction since then has been more nearly correlated to its demand. From 1925 to 1928, the number of sections increased 88 per cent, while the annual production of hosiery also increased 88 per cent.

There is plotted on Chart IV a curve representing yearly production of sections in order to emphasize the rapid increase in production in 1925 and 1926. More important, however, are the curves comparing the increase in cumulative section production with full-fashioned hosiery output. The lag in the curve representing the former indicates that, based on total sections produced by 1924, annual hosiery production has increased at a greater rate than additions of sections to the industry. Since 1925, the rates of increases in sections and in hosiery production have been almost identical.

While it seems quite possible that the 1923 and 1924 difficulties rested upon equipment increases that were not correlated to the demand for full-fashioned hosiery, it also seems to be clear that some other factor must be largely responsible for the seasonal fluctuations in hosiery output since 1925. In the last four years, with increasing competition among hosiery manufacturers, the double shift has been utilized to a greater extent as a means of cutting individual

costs. That this movement has recently become important is evident from the classification of machines in Table 17. In 1925, over three leggers were produced for each footer. This ratio declined yearly until, in 1928, slightly over two leggers for one footer were produced and imported. Ordinarily, on account of the shorter time of operation per stocking, one footer can handle the product of three leggers. The task of the topper or transfer bar topper being performed by women,[13] it becomes a legal impossibility to run two shifts on the footer. Accordingly, many manufacturers increase the number of their footers, which are still operated on a single shift, and, place their leggers on a two-shift basis. In spite of union opposition, this method of operation is becoming almost universal.[14]

Only three mills in the Reading area run leggers on a single shift. Of a total number of 59 mills reporting the number of shifts operated,[15] only 16 operated single shifts on both leggers and footers. The rest operated two or three shifts for leggers, and one or two shifts for footers. Other mills than the 59 report that they intend operating on a two-shift basis in the near future.

However, what proof have we that this method of operation did not always prevail in the industry? People in the trade have attested to the recentness of the policy, but we have a more objective measure. If there is a trend to the operation of two shifts for leggers as compared to one for footers, then the building of machinery should show a decreasing ratio of leggers to footers. Instead of producing three leggers for one footer, footers alone will be built for old firms beginning the new policy, while new firms will equip themselves with two leggers for each footer. This

[13] Attempts have been made and are being made to train boys for this operation, but as yet little progress has been made in supplanting women.

[14] One large importer deprecates such use of the leggers to manufacturers using his machine. His opposition rests upon the feeling that a shorter life to the machine results, not so much because of extra strain on the machinery, but because, when no one man is responsible for the machine, it receives but little attention.

[15] In answer to a questionnaire.

will be so if the equipment unit of production is becoming not four machines on a single shift, but two leggers on a double shift and one footer on a single shift.

Table 17 measures this trend by differentiating in the yearly production and importation of machines between leggers and footers, listing the ratio between them. This table is a classification of the same machines reported in Table 14.

TABLE 17

ANNUAL PRODUCTION AND IMPORTATION OF FULL-FASHIONED HOSIERY MACHINES CLASSIFIED BY LEGGERS AND FOOTERS

1919–1928

| Year | Leggers | Footers | Ratio of Leggers to Footers |
|---|---|---|---|
| 1919 | 227 | 73 | 3.11 |
| 1920 | 429 | 164 | 2.62 |
| 1921 | 576 | 213 | 2.70 |
| 1922 | 785 | 247 | 3.18 |
| 1923 | 468 | 210 | 2.23 |
| 1924 | 327 | 144 | 2.27 |
| 1925 | 855 | 284 | 3.01 |
| 1926 | 1,565 | 569 | 2.75 |
| 1927 | 1,264 | 467 | 2.71 |
| 1928 | 1,097 | 523 | 2.10 |
| Total | 7,593 | 2,894 | 2.62 |

It seems apparent from Table 17 that some force operating in the industry is bringing about a more general use of the double shift. The production of leggers and footers from 1919 to 1922 was almost three to one. As business became less favorable in 1923 and 1924, machinery was constructed at a ratio of slightly more than two leggers to one footer, an indication that firms were going on to a double shift for leggers, presumably to lower their production costs through decreasing fixed charges per unit of production. With the 1925 upswing and comparatively good business in both 1925 and 1926, proportionately more leggers were added to operate to a greater extent on a single shift [16] so that, when competition became more severe in 1927 and

[16] A possible explanation is that the union may be better able to enforce its demands for single shift in times of relative prosperity.

1928, the demand was for more footers to enable the previously acquired leggers to go on a double shift.

In considering the import of the decreasing ratio of leggers to footers, some attention must be paid to the use of longer footers. The tendency to use 24-, 28- and even 30-section footers with leggers of fewer sections has made it possible for one footer to use the product of a greater number of leggers. The decreased ratio of leggers to footers has thus been caused by the use of long-section footers and the increased use of the double shift.

If the double shift is being used to reduce costs and thus to secure an advantage in competition, those in the full-fashioned hosiery industry should realize that such activity results in an increase in equipment potentialities. While the double shift may decrease the overhead per dozen pairs for the individual manufacturer, it results in increased production at a time when seasonality and stock on hand are already increasing, as at present. It would seem more desirable to use the double shift only to meet the increased demand of boom years instead of increasing hosiery production at such a time by the addition of more equipment. However, industry governed by competitive motives acts as appears best for the individual manufacturer. He sees the double shift as a means of cutting overhead when competition is severe. He acts on that basis, failing to foresee the possible demoralizing effect of the increased production on the industry. He sees only that if he adds a footer to each unit of four machines and if he runs his leggers two shifts, he can double his productive capacity by increasing the number of knitting machines by 25 per cent.

To the increased use of the double shift for leggers, then, must be attributed some of the increasing production of the full-fashioned hosiery industry and the consequent increase of seasonality and fluctuation in unfilled orders and stock on hand. This method of operation is undoubtedly equivalent to an increase of equipment in its effect on production. To the practice must be ascribed some of the increasing season-

ality of the industry, as well as the trends in unfilled orders and stock on hand.

Not only does the manufacturer apparently seek to decrease overhead when competition becomes stern by using the double shift, but he looks longingly at the possibility of securing a decreased labor cost and overhead cost per stocking through the use of the double-machine or the multiple-machine system.[17] Where it has jurisdiction the union has strictly insisted upon the single machine system, in principle. We need not discuss the reason for its insistence further than to mention its fear of a development of a surplus supply of knitters by the double-machine system. Under this system of operation, numerous helpers learn the trade and, sooner or later, become knitters.

The manufacturer claims that his need for the double-machine system is caused by the excessive idle time for each machine when the single-machine system is followed. This claim is based upon the fact that the machine is stopped[18] too long for changes when they must be made by one knitter. If two men are changing, i.e., a knitter and his helper, idle time will be materially decreased. So the manufacturer views the double-machine system very favorably when he looks about to decrease costs. The Union has recognized his claim and has placed this condition in certain recent wage agreements: "Leggers are asked to help one another. This is understood to be purely voluntary and no member will be discriminated against for non-compliance."

We need not discuss the moot question of productivity per machine and cost of production, under single- and double-machine systems. Our only purpose in introducing this discussion is to emphasize that in times of stern competition the industry looks to cheaper costs through increased production as a means of solving its problem, not realizing that

[17] By the single machine system we mean that one knitter operates one machine. Under a double-machine system one knitter, aided by one or more helpers, runs two machines. Under the multiple-machine system one knitter and many helpers operate from 3 to 8 machines.

[18] Especially for beginning a new set, turning welts, etc.

increased production may be but an aggravation of the problem of increasing stocks and seasonality. And the union, fighting the double- and multiple-machine systems, must voluntarily increase production by requesting its members to aid each other in cutting down idle machine time.

One factor operating to decrease the productivity of the equipment of the full-fashioned hosiery industry should be mentioned. We have already seen that the trend of hosiery demand is for fine-gauge and sheer hosiery. 57-gauge machines are operating in the United States on silk as fine as two-thread. From 1919 to 1924, ten- and twelve-strand silk hosiery was common; now five- to seven-thread hosiery predominates, while three- and four-strand stockings are common.[19] In manufacturing the sheerer hosiery, more courses per inch are necessary, since the fine silk fills less space. Naturally the productivity of the machine is decreased. However, persons familiar with the manufacturing problems of the industry feel that this retarding influence has been more than offset by the greater speed of the newer finer-gauge machines. Our conclusions concerning increased equipment, therefore, are not invalidated by the fact that a greater number of courses per inch are required in knitting sheerer hosiery.

From the social point of view, we desire increased production, but we do not desire seasonal operation resulting from a disorderly growth of equipment. Such a situation brings about higher operating costs due to idle equipment, while it must be remembered that "continuity of employment is the indispensable basis of social and economic welfare." [20] In order further to call attention to the dangers of a too rapid increase in productive equipment, caused by either increased machinery output or by more productive methods of operating, we recall that the famous study *Waste in Industry* stated that "production capacity should be con-

[19] A few manufacturers are producing two-thread hosiery and would, they say, knit a one-thread fabric if the silk would stand the strain of knitting.

[20] Lipson, E., *Increased Production*, page 60.

servatively based upon a careful study of normal demand." [21] "Unsound production policies result in wasteful overequipment. Clothing factories are built 45 per cent larger than is necessary; printing establishments are from 50 per cent to 150 per cent overequipped; the shoe industry has a capacity of 1,750,000 pairs of shoes a day and produces little more than half that number." [22] These industries are older than the full-fashioned hosiery industry and have accumulated equipment over a long period of years. The full-fashioned hosiery industry is youthful and, beginning to expand under auspicious circumstances, seems to be unable to learn from the experiences of other industries. Apparently it too is developing its share of overequipment. And the possible remedy? The "Waste in Industry" study recommends that "Trade Associations should be formed in those industries lacking comprehensive organizations. . . . Trade Associations should collect and make public, trade information including current data on production, stocks on hand, consumption . . . and statistics of active and idle plant capacity." [23]

But, since the trade association with regulative powers is as yet non-existent in the full-fashioned hosiery industry, the business executive of the industry must realize that "management on a buyer's market is quite a different thing from management on a seller's market. On a seller's market, production is but the hasty wasteful process of giving material things a form or other quality which will satisfy insatiable and not overcritical demand; on a buyer's market it must be more precise and economical." [24] If the full-fashioned hosiery market is changing its nature, as appears from our analysis of production, the way out seems to be more attention to long run tendencies, a more accurate esti-

[21] Committee on Elimination of Waste in Industry of the Federal Engineering Society, *Waste in Industry*, page 25.

[22] *Ibid.*, page 17.

[23] *Ibid.*, page 30.

[24] Person, H. S. "Shaping Your Management," *Scientific Management since Taylor*, page 25.

mate of demand to prevent excessive inventories, and an attempt to assume a competitive position by reduction of costs based upon a more scientific internal management. Market research, master plans, budgets and the like offer the means of securing lower prices without a disorganization of distributive shares.

# CHAPTER V

## THE NATURE OF THE EQUIPMENT OF THE FULL-FASHIONED HOSIERY INDUSTRY

We have already considered the extent of the increase of equipment of the full-fashioned hosiery industry as a step in explaining the reasons for the trend of the industry to increased equipment and to a buyer's market. Not only is such a quantitative study of equipment desirable, but our previous analysis of changes in the demand for hosiery [1] suggests the possibility that qualitative changes have also taken place in the industry's equipment. We know that a satisfactory chiffon stocking cannot be produced on a 39-gauge machine.[2] The fabric is too loosely knit for fine appearance. As sheer hosiery has, in recent years, become the desired product, it seems natural to expect some change in the gauges of knitting machines produced each year, especially to expect that fewer 39-gauge machines would be constructed. In order to understand the hosiery problem, we must know the percentage of total machines in the industry represented by each gauge. It may be that the buyer's market exists only in certain gauges of hosiery that have been rendered undesirable by the style trend.

The present chapter, therefore, considers the yearly production and importation of full-fashioned knitting machines classified by gauges, as well as the number and character of the knitting machines now in operation in the United States.

In studying the trend in gauges of the yearly production of knitting machinery, data on the building of 12,565 ma-

[1] Chapter III.

[2] By chiffon hosiery we mean stockings knitted with five-strand silk or finer. Some five-strand hosiery is being knit on 39-gauge machines and is even being called chiffon, but it is not of first-class chiffon quality.

chines have been used. This total includes the entire domestic production of machinery from 1902 to 1928, which, with the available import figures, represents most of the machinery entering the industry since 1902. All machines but the imports of three comparatively unimportant makes are included in our data. Since this study is concerned mainly with the full-fashioned hosiery industry after 1919, production figures prior to that year have been grouped as one total.

In Table 18, then, after the production of all years from 1902 to 1918 has been grouped, the yearly production of numbers of knitting machines, classified by their gauge, is listed.

TABLE 18

PRODUCTION AND IMPORTATION OF FULL-FASHIONED HOSIERY KNITTING MACHINES CLASSIFIED BY GAUGE

ABSOLUTE NUMBERS

1902–1928

| Year* | Gauge of Machine | | | | | | | | | Total Output Per Year | Cumulative Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Below 36 | 36 | 39 | 42 | 45 | 48 | 51 | 54 | 57 | | |
| 1902–1918† | 106 | 165 | 1,544 | 262 | 1 | | | | | 2,078 | |
| 1919 | 1 | 10 | 237 | 52 | | | | | | 300 | 2,378 |
| 1920‡ | 2 | 10 | 447 | 134 | | | | | | 593 | 2,971 |
| 1921‡ | 3 | | 581 | 197 | 4 | | 4 | | | 789 | 3,760 |
| 1922 | 9 | | 605 | 408 | 10 | | | | | 1,032 | 4,792 |
| 1923 | 1 | | 242 | 397 | 29 | | 9 | | | 678 | 5,470 |
| 1924 | | 4 | 196 | 249 | 18 | 4 | | | | 471 | 5,941 |
| 1925 | 1 | 3 | 278 | 827 | 25 | 5 | | | | 1,139 | 7,080 |
| 1926 | 1 | 2 | 126 | 1,664 | 294 | 24 | 4 | 9 | 10 | 2,134 | 9,214 |
| 1927 | 5 | | 44 | 1,182 | 374 | 94 | 19 | 3 | 10 | 1,731 | 10,945 |
| 1928 | 22 | | 9 | 868 | 483 | 180 | 52 | 3 | 3 | 1,620 | 12,565 |
| Total | 151 | 194 | 4,309 | 6,240 | 1,238 | 307 | 88 | 15 | 23 | 12,565 | |

* Each year's production and importation of machines by gauges is given separately except for the grouping of all machines from 1902 to 1918.

† Gauge classification estimated for about 800 machines.

‡ The importation of about 100 machines in 1920 and in 1921 has been classified by gauge according to an estimate based upon the remainder of the year's production.

From this table, the trend in yearly demand toward machines capable of knitting sheerer hosiery is clear. Before 1919, 42-gauge machines were but infrequently produced, the bulk of the machinery output being of the 39-gauge type,

while machines of finer than 42-gauge were but rarely constructed. Not until 1922 did the demand for 45- and higher-gauge machinery become established, and leave the experimental stage of previous years. In 1928, the bulk of the production was of 42-gauge machines, while 45- and 48-gauge equipment were, respectively, second and third in importance. In the same year, practically no 39-gauge machines were produced, although this type was predominant in the yearly production until 1922. It is noticeable that a scattering production of 36-gauge and lower has persisted. This equipment is now used mainly for the production of wool hosiery, in the manufacture of which a coarse gauge is required.

In order more adequately to comprehend the extent of these changes that have occurred in the yearly production of full-fashioned knitting machines, Table 19 has been prepared. In this table, the percentage of each year's production of machines of each type of gauge is listed. The figures in Table 19 are percentage representations of the total machine production of each gauge listed in Table 18.

TABLE 19

PRODUCTION AND IMPORTATION OF FULL-FASHIONED HOSIERY KNITTING MACHINES CLASSIFIED BY GAUGE

PERCENTAGES

1902–1928

| Year | Gauge of Machine | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | Below 36 | 36 | 39 | 42 | 45 | 48 | 51 | 54 | 57 | |
| 1902–1918 | 5.1 | 7.9 | 74.3 | 12.6 | 0.1 | | | | | 100 |
| 1919..... | 0.4 | 3.3 | 79.0 | 17.3 | | | | | | 100 |
| 1920..... | 0.3 | 1.7 | 75.4 | 22.6 | | | | | | 100 |
| 1921..... | 0.4 | | 73.6 | 25.0 | 0.5 | | 0.5 | | | 100 |
| 1922..... | 0.9 | | 58.6 | 39.5 | 1.0 | | | | | 100 |
| 1923..... | 0.1 | | 35.7 | 58.6 | 4.3 | | 1.3 | | | 100 |
| 1924..... | | 0.9 | 41.5 | 52.9 | 3.8 | 0.9 | | | | 100 |
| 1925..... | 0.1 | 0.3 | 24 4 | 72.6 | 2.2 | 0.4 | | | | 100 |
| 1926..... | * | 0.1 | 5.9 | 78.0 | 13.8 | 1.1 | 0.2 | 0.4 | 0.5 | 100 |
| 1927..... | 0.3 | | 2.5 | 68.3 | 21.6 | 5.4 | 1.1 | 0.2 | 0.6 | 100 |
| 1928..... | 1.4 | | 0.5 | 53.6 | 29.8 | 11.1 | 3.2 | 0.2 | 0.2 | 100 |

* Less than 1/10 of 1 per cent.

While 39-gauge machines constituted between 70 and 80 per cent of each year's production from 1919 to 1921, their yearly importance as a percentage of production decreased rapidly in 1922 and 1923. The increase in the production of this type in 1924 is explainable by the previously-noted tendency of manufacturers to adopt the double shift in the depression of that year. We have seen that, in starting the double shift, an increase in footers is usually made to balance the production of the leggers, who work two shifts. Since in 1924 most firms had 39-gauge equipment, the beginning of the double-shift policy meant a demand for the same kind of machinery that was already in operation. The comeback of the 39-gauge machine was temporary, for the decrease in yearly production was certain and rapid after 1924. In 1921, over 73 per cent of the knitting machines produced were 39-gauge; in 1928, just one-half of 1 per cent. We can very definitely say that the demand for sheer hosiery has led to a lack of demand for 39-gauge equipment. Certainly the change in gauge of knitting machinery has been little short of revolutionary.

Contemporary with the decreased production of 39-gauge machinery, there occurred, from 1919 to 1925, an increase in the relative output of 42-gauge machinery. This type grew from 22 per cent of yearly production in 1920 to over 72 per cent in 1925. Beginning with 1926, however, 45-gauge machinery became an important percentage of the yearly output—by 1928 almost 30 per cent. In like manner, the percentage of yearly output of 48-gauge machinery has increased in 1927 and 1928, rising to over 11 per cent of the 1928 production from almost no production in 1925. The still finer gauges, 51, 54 and 57,[3] still make up a very small proportion of the yearly output.

As the trend toward a higher number of sections was almost revolutionary,[4] so the trend toward finer gauges has, in

[3] The production of gauges finer than 51 has not developed rapidly. Hosiery knit on such machines is so perishable as to appeal to a very limited market.

[4] See page 65.

a few years, completely changed the relative share of production supplied by the various gauges. The rapidity of the gauge trend is of such importance that we may well present the changes shown by the figures of Table 19 in the form of a chart. Chart V represents the percentages of yearly production of knitting machines of each gauge. It emphasizes the rapid decrease in the yearly production of 39-gauge machines, corresponding to the increase in 42-gauge equipment, which in turn has begun to decrease in relative importance during the last two years. In those years, 45- and 48-gauge machinery assumed more importance as a part of the yearly output.

If the manufacturer of hosiery no longer desires 39-gauge machinery, it must be because he can more easily sell the product of finer-gauge machines. These he is certainly demanding to the exclusion of 39-gauge machinery. But what of the large number of coarser-gauge machines previously produced? Most of these are still capable of producing hosiery, for most were first used after 1918. Table 18 shows that 1544 39-gauge machines were produced before 1919 and 2765 after 1918. Most of these machines are less than ten years old, and can be considered efficient from the point of view of production.[5] The conclusions reached pertaining to the trends of yearly production to finer-gauge machines lead to the necessity of knowing not only the yearly production of machines by gauges, but the cumulative production of machines classified by gauges as well. In a year of low production a large percentage of one type of machine may have but little effect upon the total supply of machinery. Moreover, we need a record of the changing makeup of all the machinery of the industry through figures of the percentage of all production represented by each gauge at the end of each year. The yearly production shows the trend in demand for various types of machines, but it does not show

[5] Persons in the trade usually consider that a full-fashioned hosiery machine will operate efficiently for 15 years, although they are often mechanically efficient at the end of 25 years of operation.

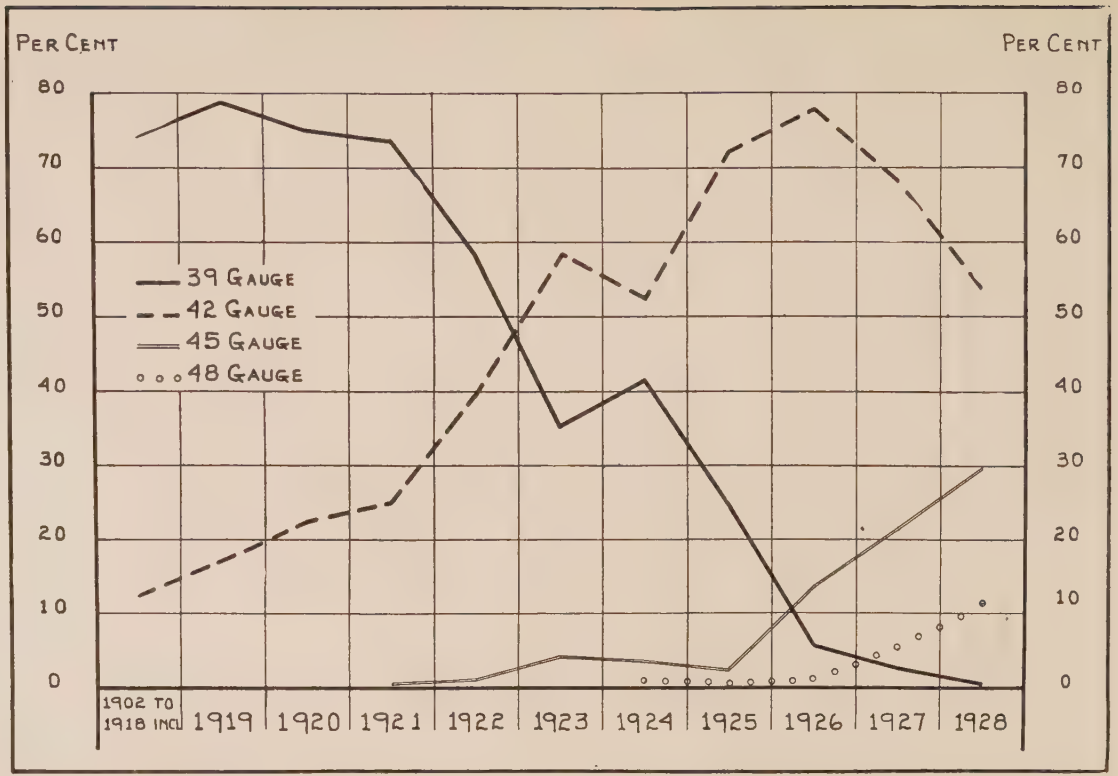


CHART V. PERCENTAGE OF YEARLY PRODUCTION OF FULL-FASHIONED HOSIERY KNITTING MACHINES BY GAUGE 1902-1928

the extent to which the changed demand affects the character of the total supply of equipment.

With this in mind, Table 20 has been prepared. In it, each year's production of knitting machines, classified by gauges, has been added to the total production of previous years to obtain a cumulative total of production for machinery of each gauge. It is true that the yearly machine equipment of the industry could more accurately be secured from factory records of machinery on hand at the close of the year. To secure such data would be obviously impossible. Table 20 measures the changing importance of each type of machine in total equipment by listing production and importation of machinery, disregarding the scrapping of machinery, which has not been a very large factor.[6]

TABLE 20

CUMULATED PRODUCTION AND IMPORTATION OF FULL-FASHIONED HOSIERY KNITTING MACHINES CLASSIFIED BY GAUGE

ABSOLUTE NUMBERS

1902–1928

| Year | Gauge of Machine | | | | | | | | | Cumulative Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | Below 36 | 36 | 39 | 42 | 45 | 48 | 51 | 54 | 57 | |
| 1902–1918 | 106 | 165 | 1,544 | 262 | 1 | | | | | 2,078 |
| 1919..... | 107 | 175 | 1,781 | 314 | 1 | | | | | 2,378 |
| 1920..... | 109 | 185 | 2,228 | 448 | 1 | | | | | 2,971 |
| 1921..... | 112 | 185 | 2,809 | 645 | 5 | | 4 | | | 3,760 |
| 1922..... | 121 | 185 | 3,414 | 1,053 | 15 | | 4 | | | 4,792 |
| 1923..... | 122 | 185 | 3,656 | 1,450 | 44 | | 13 | | | 5,470 |
| 1924..... | 122 | 189 | 3,852 | 1,699 | 62 | 4 | 13 | | | 5,941 |
| 1925..... | 123 | 192 | 4,130 | 2,526 | 87 | 9 | 13 | | | 7,080 |
| 1926..... | 124 | 194 | 4,256 | 4,190 | 381 | 33 | 17 | 9 | 10 | 9,214 |
| 1927..... | 129 | 194 | 4,300 | 5,372 | 755 | 127 | 36 | 12 | 20 | 10,945 |
| 1928..... | 151 | 194 | 4,309 | 6,240 | 1,238 | 307 | 88 | 15 | 23 | 12,565 |

This table gives a complete picture of the effect of the gauge trend in the full-fashioned hosiery industry on total machine equipment. While 39-gauge machines had lost a great deal of their importance in the yearly output of machinery by 1922 and had become a mere 6 per cent of the

[6] See page 59.

yearly output by 1926, it was not until the end of 1927 that the total cumulative production of 42-gauge machines exceeded the 39-gauge cumulative total. This situation was due, of course, to the very large number of 39-gauge machines produced before 1922, when they comprised virtually the entire production. So, even at the close of 1928, a very large proportion of the total cumulative production of machines and, hence, of the machines in operation, was of the 39-gauge type. This is true even though the production of this type constituted less than 1 per cent of the machinery output in 1928. It is interesting to note that the most radical changes in the composition of the total equipment have occurred since 1925. After that year when sheerness was demanded, the entire makeup of machine equipment changed—at a time when other management problems were assuming importance.

In order to comprehend more clearly the importance of different gauges in the supply of machinery at different years since 1918, Table 21 has been introduced. Using the production figures of Table 20, the following compilation trans-

TABLE 21

CUMULATED PRODUCTION AND IMPORTATION OF FULL-FASHIONED HOSIERY KNITTING MACHINES CLASSIFIED BY GAUGE

PERCENTAGES

1902–1928

| Year | Gauge of Machine | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | Below 36 | 36 | 39 | 42 | 45 | 48 | 51 | 54 | 57 | |
| 1902–1918.. | 5.1 | 7.9 | 74.3 | 12.6 | 0.1 | | | | | 100.0 |
| 1919..... | 4.5 | 7.4 | 74.9 | 13.1 | 0.1 | | | | | 100.0 |
| 1920..... | 3.7 | 6.2 | 75.0 | 15.1 | * | | | | | 100.0 |
| 1921..... | 3.0 | 4.9 | 74.7 | 17.2 | 0.1 | | 0.1 | | | 100.0 |
| 1922..... | 2.5 | 3.9 | 71.2 | 22.0 | 0.3 | | 0.1 | | | 100.0 |
| 1923..... | 2.2 | 3.4 | 66.8 | 26.6 | 0.8 | | 0.2 | | | 100.0 |
| 1924..... | 2.1 | 3.2 | 64.8 | 28.6 | 1.0 | 0.1 | 0.2 | | | 100.0 |
| 1925..... | 1.7 | 2.7 | 58.3 | 35.7 | 1.3 | 0.1 | 0.2 | | | 100.0 |
| 1926..... | 1.3 | 2.1 | 46.2 | 45.5 | 4.1 | 0.4 | 0.2 | 0.1 | 0.1 | 100.0 |
| 1927..... | 1.2 | 1.8 | 39.2 | 49.1 | 6.9 | 1.2 | 0.3 | 0.1 | 0.2 | 100.0 |
| 1928..... | 1.2 | 1.5 | 34.4 | 49.6 | 9.9 | 2.4 | 0.7 | 0.1 | 0.2 | 100.0 |

*Less than 1/10 of 1 per cent.

lates the cumulative production of machines by gauges into percentages of total machinery produced. For instance, of all the machinery produced from 1902 to 1919, 75.4 per cent was 39-gauge equipment, while of all machinery produced from 1902 to 1928, 34.8 per cent was 39-gauge machinery.

We can readily see that while 39-gauge machinery is rapidly decreasing as a percentage of the total equipment, it still comprises over one-third of the total machinery in use. If such a large percentage of the industry's total machinery is of a type no longer produced to any extent, it seems possible that the owner of these machines may be having difficulties in disposing of his product. Is it possible that management problems are confined to the use of these machines? Of course, there will always be some demand for service weight hosiery, which can be well supplied from either 39- or 42-gauge machinery. However, unless this 39-gauge equipment, now about one-third of the total, is nicely balanced to meet the demand for the heavier service weight, it will be difficult to market at least some of its output. A more probable condition is that the shift in demand to sheerer hosiery has resulted in a decreased use of service weight hosiery, and a merchandising problem to the mill operating 39-gauge equipment. On the other hand, this problem may be no greater than that faced by owners of finer gauge machinery. It is difficult adequately to answer the question. Some mills with 39-gauge equipment are producing service weights on these machines. Others are attempting to manufacture a five-thread chiffon stocking, usually to sell at about a dollar, which, however, seems loosely knitted and of comparatively poor quality. Certain factories are manufacturing a seven- or eight-strand stocking of one of the new lusterless rayons, expecting to sell the product on price and not on sheerness. In most cases, the consumer of full-fashioned hosiery probably does not buy stockings by gauge. Sheerness is desired, and if the product of the 39-

gauge machine seems to lack this quality, it will not be purchased.

The significant changes in the full-fashioned hosiery industry already discussed may thus affect only one kind of hosiery. It may be that most of the price-cutting, most of the stock on hand, etc., are limited to 39-gauge hosiery. And it may be that if the owner of these machines finds their operation unprofitable, he may be forced to scrap or sell them. In other words, the change in style that made these machines less desirable may make them valueless enough to scrap, in spite of their productive capacities. Whether or not such scrapping is taking place will be discussed later.

From Table 21 we see that the percentage of total production represented by 39-gauge machines has been steadily decreasing since 1920, while the percentage of 42-gauge equipment has increased yearly without exception, though in recent years at a decreasing rate. At present it includes about one-half of the total equipment of the industry. While about 10 per cent of the total equipment on hand in 1928 was of the 45-gauge type, machines capable of knitting sheerer than 45-gauge hosiery constitute, as yet, a very small proportion of the total equipment.

It would indeed be difficult to forecast future trends in gauges. The 42-gauge machine seems very flexible. It can knit both service weight and chiffon hosiery of good quality. The 39-gauge machine produces mainly service weight hosiery, while machines of finer gauge than 42 must produce mainly chiffon. The owner of 42-gauge equipment has a flexible machine, but if the trend to sheerness continues, it may be that his chiffon will be undesirable compared to the sheerer chiffon of finer-gauge machines. On the other hand, it is not altogether impossible that if the style in women's dress again turned to longer skirts, the longer-wearing qualities of service weight hosiery might cause a revival of the demand for this product. It would be strange indeed if such a right-about-face occurred to make the 39-gauge machines more valuable than those of finer grades.

Chart VI is a graphic representation of the change in the total cumulative production of machines of each type of gauge, as developed in Table 21. The decline of the 39-gauge, the slowing up of the 42-gauge in recent years and the recent increase of 45- and 48-gauge equipment can be readily seen from the chart. It must be clearly borne in mind that Chart VI represents the percentage of each gauge included in the total cumulative production as of the end of each year. This chart emphasizes the rapidity of the change in the nature of the machine equipment of the industry and the comparatively large percentage of total equipment represented by the 39-gauge machine. It is also evident that 85.4 per cent of all equipment produced to the end of 1928 has been either 39- or 42-gauge machinery.

A further question must receive consideration before our conclusions concerning the extent of the 39-gauge equipment now in the industry can be held. Maybe many of the 39-gauge machines have already been scrapped. While one-third of the total of machines produced were 39-gauge, it may be that less than this percentage is now actually operating in the industry. If so, these machines could not be the cause of seasonal operation,[7] nor could their scrapping in the future offer a means of eliminating overproduction.

In order to arrive at an estimate of the type of machines actually in operation in the industry,[8] a census of equipment was undertaken.[9] Of the 263 mills manufacturing women's full-fashioned hosiery in the United States as of February 1929, a complete record of the number of machines in operation, classified by leggers and footers, gauge and number of sections, is at hand for 202 factories, or for nearly 77 per cent of the total number. For 48 additional mills, data have been secured of the number of machines, classified only by

[7] Even if these machines are responsible for some seasonality, some responsibility may also rest upon machines of other gauges.

[8] As of about March 1929.

[9] A questionnaire sent to all hosiery manufacturers supplied some information for this census. However, information was also secured from three other sources that proved to be very reliable. Unfortunately, these sources may not be disclosed.

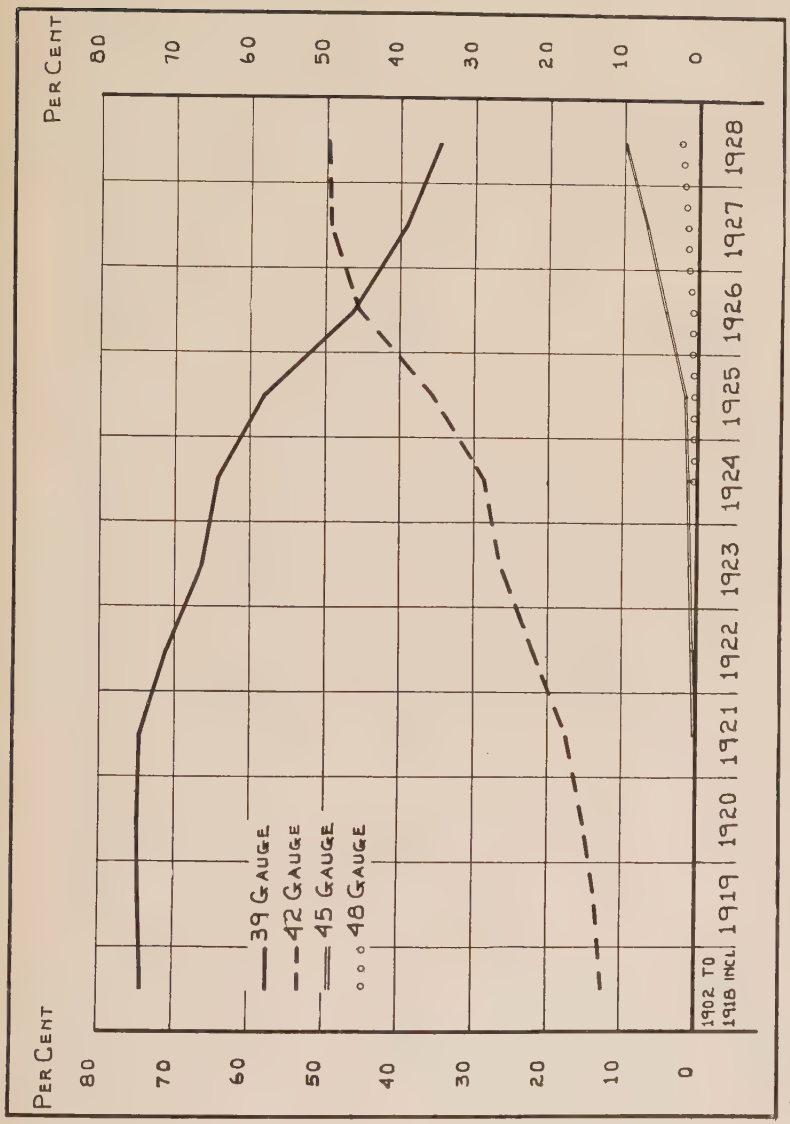


CHART VI. PERCENTAGE OF CUMULATED PRODUCTION OF FULL-FASHIONED HOSIERY KNITTING MACHINES BY GAUGE 1902-1928

leggers and footers. From six mills, only partial data have been secured concerning the number and nature of the machines on hand, while for seven mills we have no information at all.

It will be seen that data of the number of machines only, have been secured for 250 mills, and partially for six additional, or a total of 263 establishments. The number of machines so located has totaled 11,370 machines, divided into 8,413 leggers and 2,957 footers. Unofficial estimates of the machine equipment in the six mills of which we have incomplete data and in the seven mills of which we have no data would increase our machine total by 534. Assuming this estimate to be correct, the number of full-fashioned hosiery machines in operation in the United States as of March 1, 1929, was 11,904. Complete detailed classification of equipment has been secured for 202 mills, and partial details for six more. The data so secured cover information on 8,759 machines. This number is over 73 per cent of the total number (11,904) of machines in operation.

Our conclusions concerning the type of knitting machine now in operation in the United States are, therefore, based upon data for over 73 per cent of the total machines in nearly 77 per cent of the mills. The correspondence in these two percentages seems to indicate that the mills we have used have been typical.

In Table 22 we have computed the percentage of the total machines covered by our survey in each gauge group. Classification of each group of machines by number of leggers and footers has also been made.

Our census of machines in operation shown in Table 22 substantiates the use made of the figures of machinery construction as a measure of equipment in use. As shown in this table, of the 8,759 machines now in operation, 50.5 per cent are 42-gauge equipment. From the records of machinery manufacturers, the combined yearly production of 42-gauge equipment was 49.6 per cent of a total construction

TABLE 22

FULL-FASHIONED HOSIERY KNITTING MACHINES OPERATING IN THE UNITED STATES*

March 1, 1929

(Classified by gauge)

| Gauge of Machine | Total | Per Cent | Leggers | Footers | Ratio of Leggers to Footers |
|---|---|---|---|---|---|
| 36 and under | 314 | 3.6 | 233 | 81 | 2.88 |
| 39 | 2746 | 31.4 | 2052 | 694 | 2.96 |
| 42 | 4420 | 50.5 | 3275 | 1145 | 2.85 |
| 45 | 904 | 10.3 | 662 | 242 | 2.74 |
| 48 | 354 | 4.0 | 254 | 100 | 2.54 |
| 51 | 16 | .2 | 11 | 5 | 2.20 |
| 54 | 5 | † | 4 | 1 | 2.50 |
| Total | 8759 | 100.0 | 6491 | 2268 | |

* 73 per cent of all machines in 77 per cent of all establishments.
† Less than 1/10 of 1 per cent.

of 12,565 machines. We seem justified in saying that over half of all full-fashioned knitting machinery is 42-gauge.

Of all knitting machines produced, we have already seen that nearly 35 per cent were 39-gauge.[10] Table 22 shows that of all machines now in operation, 31.4 per cent are 39-gauge. This figure would seem to imply that some scrapping of 39-gauge machines has taken place, although not a very large percentage of the total of machines produced. It would also seem to substantiate our conclusions concerning the use of this equipment in the industry. A large part of the industry's equipment is 39-gauge although practically no machines of this type are now being produced. Furthermore, very few of these machines have been discarded.

A check-up on machines of gauges other than 39 and 42 reveals a close correspondence between the production figures shown in Table 21 and the machines in use as developed in Table 22. Slight differences in the percentages of higher gauge machines arrived at from the two sources can be explained by the inclusion or exclusion of a few machines from one table, which, owing to the small totals of these gauges, have a noticeable effect on the percentage computation.

[10] See page 85.

In Table 22 we have listed not only the total machines of each gauge but also the total machines classified by leggers and footers for each gauge. A ratio of leggers to footers has been computed for each gauge in order to reveal any tendency toward the use of the double shift in certain gauges and not in others. Double-shift frequency can be measured by this ratio, since if a company has three leggers to one footer, a double shift is impossible. It is noteworthy that in no gauge-class was a 3 to 1 ratio attained. The nearest approach to the single shift basis was in the 39-gauge class where there were 2.96 leggers to each footer. Practically all 39-gauge machines were run on single shift, unless both leggers and footers were run two shifts, as happens only infrequently. A possible reason for the greater use of the single shift with 39-gauge machinery may be that most of the 39-gauge equipment is owned by the older mills in the established districts. It may be that there the union has greater power to limit the number of shifts. For our study, it seems important to recognize that, as the gauges on machines become finer, the double shift is used to a greater extent. The demand for the product of 39-gauge machines may not be sufficiently large to call for the operation of two shifts, but a large demand for very sheer hosiery may require double shifts.

In making the census of the machines actually in use, it was thought desirable to compute the numbers and percentages of total machines classified by number of sections. We have already noted the trend to a greater number of sections per machine.[11] A question then arose regarding the ability of 18-section machines to compete in production with the newer 24- and 28-section types. In order to compute the relation between numbers of longer and shorter machines now in operation, Table 23 has been prepared. From this table we may get an idea of how many of the shorter machines now operate.

[11] See page 66.

TABLE 23

FULL-FASHIONED HOSIERY KNITTING MACHINES OPERATING IN THE UNITED STATES

March 1, 1929.

Classified by number of sections and by leggers and footers.
Absolute Numbers and Percentages

| Sections per Machine | Number of Machines | | | Per Cent of Total | Per Cent of Leggers | Per Cent of Footers |
|---|---|---|---|---|---|---|
| | Total | Leggers | Footers | | | |
| 12..... | 12 | 10 | 2 | .1 | .2 | .1 |
| 14..... | 10 | 5 | 5 | .1 | .1 | .2 |
| 16..... | 13 | 12 | 1 | .2 | .2 | |
| 18..... | 3470 | 3101 | 369 | 39.6 | 47.8 | 16.3 |
| 20..... | 3685 | 2273 | 1412 | 42.1 | 35.0 | 62.3 |
| 22..... | 16 | 3 | 13 | .2 | | .6 |
| 24..... | 1469 | 1083 | 386 | 16.8 | 16.7 | 17.0 |
| 26..... | 1 | 0 | 1 | * | | * |
| 28..... | 83 | 4 | 79 | .9 | | 3.5 |
| Total..... | 8759 | 6491 | 2268 | 100.0 | 100.0 | 100.0 |

* Less than 1/10 of 1 per cent.

The foregoing table shows a concentration of equipment in the 18-, 20- and 24-section groups. However, a previous analysis has shown that only in recent years has the 24-section type been developed. At present almost 40 per cent of all machines in operation are of 18 sections each, while over 42 per cent have 20 sections. Accordingly, 82 per cent of all machines consist of 18 and 20 sections while we have seen that over 85 per cent are 39- and 42- gauge. These groups comprise most of the equipment. If the 18-section machine cannot compete with the 24, a great deal of equipment will become useless on this score. By dividing the machines now in operation into leggers and footers, and then classifying them by sections, as was done in Table 23, much light is thrown upon methods of operating. While nearly 48 per cent of all leggers are of 18 sections, only 16 per cent of the footers are of this length. Furthermore, 35 per cent of all leggers are 20-section while 62.3 per cent of the footers are of this length. Much of the trend to a higher number of sections has been in the production of footers. The percentage of output of 24-section machines is about the

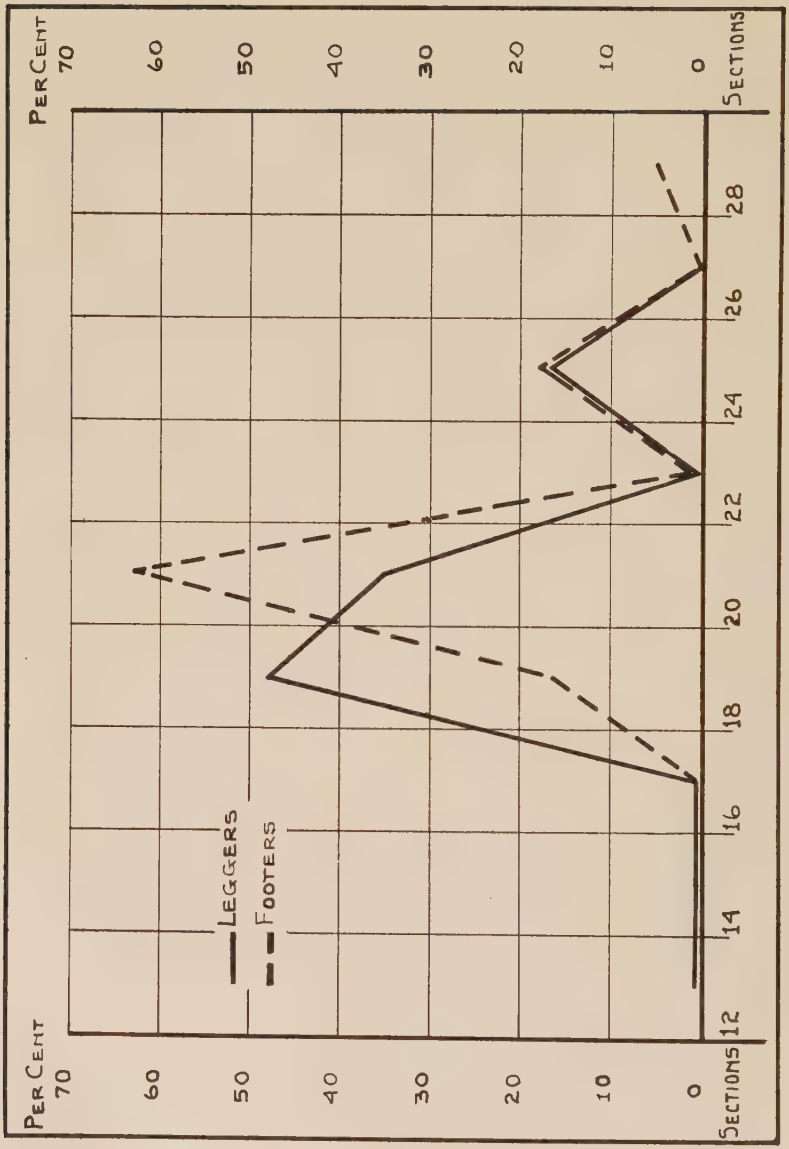


CHART VII. FULL-FASHIONED HOSIERY KNITTING MACHINES IN OPERATION IN THE UNITED STATES CLASSIFIED BY SECTIONS PER MACHINE MARCH 1, 1929

same for leggers and footers, but while practically no 28-section leggers have been placed in operation, over 3 per cent of all footers in operation are 28-section machines.

The tendency toward the use of a greater number of sections in the footers than in the leggers can best be seen through Chart VII, which shows the concentration of leggers in the 18- and 20-section groups and of footers in the 20-section group with a noticeable proportion of 28-section footers. This chart is based upon the percentages of leggers and footers of the same number of sections as revealed in Table 23.

We have seen that although few 39-gauge machines are now being produced, about one-third of the machines in operation are of this gauge. We have also seen that while very few 18-section machines are now being produced, about 40 per cent of the total equipment of the industry is of this type of machine. We have already raised the question of the ability of mills with this equipment to operate in competition with mills equipped with the newer machines. One further observation should be made in this respect. How many machines now in operation in the full-fashioned hosiery industry are both 39-gauge and 18-section machines? It would seem that manufacturers using such machines would find competition especially difficult in production as well as in lack of demand for their product.

Using the figures for the 8,759 machines on which we have complete data, Table 24 compares gauge numbers with section numbers by numbers of machines and by percentage of total machines.

While the largest percentage of any one class of machines in operation is 24.2 per cent representing 42-gauge, 20-section machines, the 39-gauge, 18-section machine group totals 20.7 per cent of the number of machines in the industry. In other words, over one-fifth of the equipment of the industry seems ill-adapted to meet the style demands of the consumer or the efficiency demands of competition. Moreover, more than 9 per cent of the total machinery reported

## TABLE 24

FULL-FASHIONED HOSIERY KNITTING MACHINES OPERATING IN THE UNITED STATES

March 1, 1929

Classified by gauge and number of sections

| Sections per Machine | Gauge of Machine | | | | | | | | | | | | | | Total Machines | Per Cent of Machines |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 36 and Under | | 39 | | 42 | | 45 | | 48 | | 51 | | 54 | | | |
| | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | | |
| 12 | | | | | 1 | * | | | 11 | .1 | | | | | 12 | .1 |
| 14 | | | 2 | * | 6 | .1 | 2 | * | | | | | | | 10 | .1 |
| 16 | 4 | * | 3 | * | | | | | 1 | * | | | 5 | .1 | 13 | .1 |
| 18 | 238 | 2.6 | 1816 | 20.7 | 1331 | 15.2 | 52 | .6 | 33 | .4 | | | | | 3470 | 39.5 |
| 20 | 60 | .9 | 795 | 9.1 | 2122 | 24.2 | 518 | 5.9 | 177 | 2.0 | 13 | .2 | | | 3685 | 42.3 |
| 22 | | | 10 | .1 | | | 5 | .1 | 1 | * | | | | | 16 | .2 |
| 24 | 12 | .1 | 119 | 1.4 | 894 | 10.2 | 310 | 3.5 | 131 | 1.5 | 3 | * | | | 1469 | 16.7 |
| 26 | | | 1 | * | | | | | | | | | | | 1 | * |
| 28 | | | | | 66 | .8 | 17 | .2 | | | | | | | 83 | 1.0 |
| Total machines | 314 | | 2746 | | 4420 | | 904 | | 354 | | 16 | | 5 | | 8759 | |
| Per cent of machines | | 3.6 | | 31.3 | | 50.5 | | 10.3 | | 4.0 | | .2 | | .1 | | 100.0 |

* Less than 1/10 of 1 per cent.

was 39-gauge, 20-section equipment. Practically all the 39-gauge machinery is limited to 18 and 20 sections, while almost all of the 45- and 48-gauge machines are composed of a larger number of sections.

Table 25 presents the foregoing data more concisely and, in addition, differentiates by classes of gauge and section between leggers and footers. As we would expect, most of the 39-gauge, 18-section machines are leggers, the footers generally being machines of the higher numbers of sections.

TABLE 25

FULL-FASHIONED HOSIERY KNITTING MACHINES OPERATING IN THE UNITED STATES

March 1, 1929

Percentages of total, leggers and footers. Classified by gauge and number of sections.

| Gauge | Sections | Per Cent of Total | Per Cent of Leggers | Per Cent of Footers |
|---|---|---|---|---|
| 42 | 20 | 24.2 | 21.1 | 33.3 |
| 39 | 18 | 20.7 | 25.2 | 8.0 |
| 42 | 18 | 15.2 | 18.7 | 5.3 |
| 42 | 24 | 10.2 | 10.7 | 8.9 |
| 39 | 20 | 9.1 | 5.6 | 18.9 |
| 45 | 20 | 5.9 | 5.8 | 6.3 |
| 45 | 24 | 3.5 | 3.6 | 3.5 |
| 36 and under | 18 | 2.6 | 2.7 | 2.7 |
| 48 | 20 | 2.0 | 1.8 | 2.7 |
| 48 | 24 | 1.5 | 1.5 | 1.4 |
| 39 | 24 | 1.4 | .7 | 3.2 |
| 42 | 28 | * | .0 | 2.8 |
| Balance | | 3.7 | 2.6 | 3.0 |
| | | 100.0 | 100.0 | 100.0 |

* Less than 1/10 of 1 per cent.

As most of the machines produced have been of 39- and 42-gauge and of 18- and 20-sections, these predominate in our analysis. It is worthy of note that 39- and 42-gauge machines of 18 sections per machine comprise 35.9 per cent of total equipment, and that except for a few 18-section machines below 39-gauge, no other classes having 18 sections are large enough to be taken into account. That is, they are less than 1 per cent of the total number of machines.

The purpose of this chapter has been to study the effect

of style changes upon the type of machine produced each year, particularly upon the gauge of these machines. Very definite trends to finer-gauge machinery have been shown. By handling the yearly production figures of machine producers cumulatively, we arrived at an understanding of the composition of the total machinery in operation in the United States to-day. The percentages of this total represented by each type of gauge produced checked very closely with a census made of the equipment of 202 mills as of March 1, 1929. These studies show that a considerable proportion of the equipment now operating is of the 39-gauge variety.

We next computed the distribution of sections by percentages of total leggers and footers in operation and found that over 40 per cent of the machines were 18-section equipment. Then gauge and section were compared, especially to note the percentage of total equipment represented by 39-gauge, 18-section machinery, which totaled over 20 per cent of the industry's equipment. Previously we considered the quantitative increase in equipment. We now see qualitative changes that may be tending to render certain equipment obsolete.

On account of the trend in the demand for sheer hosiery, knitting machinery capable of knitting service weight hosiery only is no longer being produced. Since such machinery now constitutes over one-third of the industry's equipment, may we attribute a potent cause of production problems to this group of machinery? The fact that these machines, compared to the machines making sheerer hosiery, do not seem to be operated on the double shift may be evidence that their product is not demanded to the same extent as that produced on finer-gauge machinery. It may be that a continuance of the production problems of the industry may be prevented by the scrapping of this machinery. Not only is this 39-gauge machinery incapable of knitting chiffon hosiery, but 20 per cent of the industry's equipment is both 39-gauge and 18-section. Since no more 18-section or 39-gauge machines are produced, it seems almost impossible for this 20 per cent to continue production efficiently. The scrapping

of these machines might change the whole aspect of the relation of production to consumption for the entire industry.

However, the manufacturer having 39-gauge, 18-section equipment will not voluntarily scrap machinery that turns out goods. Especially if he lacks an adequate cost system, he may continue to operate these machines, though they may earn little or no profit. If the products of these machines are to be sold, it must be on a price appeal, since they are not sheer hosiery. And a cheap product on the market tends to depress the price of all hosiery, even of the better grades as more competition enters the hosiery field.

Our next step will be to study the output of hosiery actually produced on 39-gauge and on other machines to reveal whether or not 39-gauge machines are producing fewer stockings per machine. A record of actual machine scrapping will also be presented in order to discern whether 39-gauge equipment is actually being scrapped.

# CHAPTER VI

## PRODUCTIVITY OF DIFFERENT TYPES OF KNITTING MACHINERY

Our study so far has revealed a rapid growth in production that has been characterized by increasing seasonality and fluctuations in demand due to a combination of equipment increases and more effective operation of equipment. The changes in gauge and number of sections of the machines entering the industry, has led us to consider whether difficulties are confined to the output of older machines, and whether a discarding of the older equipment in the near future will result in the solution of the problem involved in increasing the equipment of the industry.

If equipment is to be discarded, the cause must be its lack of ability to produce enough units to compete with newer machines which produce at lower unit costs or the fact that its product is not so greatly desired. It is now our intention to compare the productivity of 39-gauge equipment with that of a group including 42- and higher-gauge machinery. The monthly production of women's full-fashioned hosiery classified into these two groups, (39-gauge and lower, and 42-gauge and higher) [1] has been secured by questionnaire from 86 mills, or from 33.1 per cent of all mills. The equipment in these establishments includes 3326 machines, or about 28.4 per cent of all the machines in the industry. From these returns we have placed in Table 26 the combined production of full-fashioned hosiery for the reporting firms classified into production of 39-gauge hosiery and of 42- and higher-gauge.

[1] While one group, "39-gauge and lower" was reported, practically no hosiery lower than 39-gauge was manufactured by reporting firms. Accordingly, this group actually shows the production of 39-gauge hosiery.

TABLE 26

MONTHLY PRODUCTION OF WOMEN'S FULL-FASHIONED HOSIERY BY 65 MILLS IN 1928

(Dozen pairs, classified by gauge)

| | Gauge of Hosiery | |
|---|---|---|
| | 39 and Lower | 42 and Higher |
| January | 163,354.75 | 245,027.08 |
| February | 171,812.50 | 266,775.83 |
| March | 187,675.67 | 304,969.92 |
| April | 167,093.58 | 280,189.67 |
| May | 179,920.17 | 301,698.75 |
| June | 176,996.42 | 300,833.42 |
| July | 148,459.58 | 265,568.83 |
| August | 178,105.42 | 314,547.75 |
| September | 179,236.00 | 316,307.92 |
| October | 191,013.75 | 354,591.25 |
| November | 184,174.92 | 355,661.58 |
| December | 166,282.58 | 329,010.75 |
| Total | 2,094,125.34 | 3,635,182.75 |

A total production of 5,729,308 dozen pairs of hosiery is represented by Table 26. This is nearly 26 per cent of the total production for the year, and comes from 65 firms.[2] Of these establishments, 7 manufactured 39-gauge hosiery only, 38 produced only a 42- or higher-gauge product, while 20 turned out both classes of merchandise. Our purpose in classifying production into these two groups is to note any evidence that the product of the 39-gauge machine is governed by different demand factors than that of higher gauge machines. If so, then the seasonal production of 39-gauge hosiery might be different from that of 42- and higher gauges. In order to use the data of Table 22 to show seasonality, Chart VIII has been prepared. Remembering that it covers the monthly production of nearly 26 per cent of the 1928 hosiery output, we obtain some idea from this chart of the fluctuation in production of the two classes of product.

According to Chart VIII, the major seasons are identical

[2] While questionnaire returns were secured from 86 establishments, it was impossible to list the production of new firms running only a part of the year.

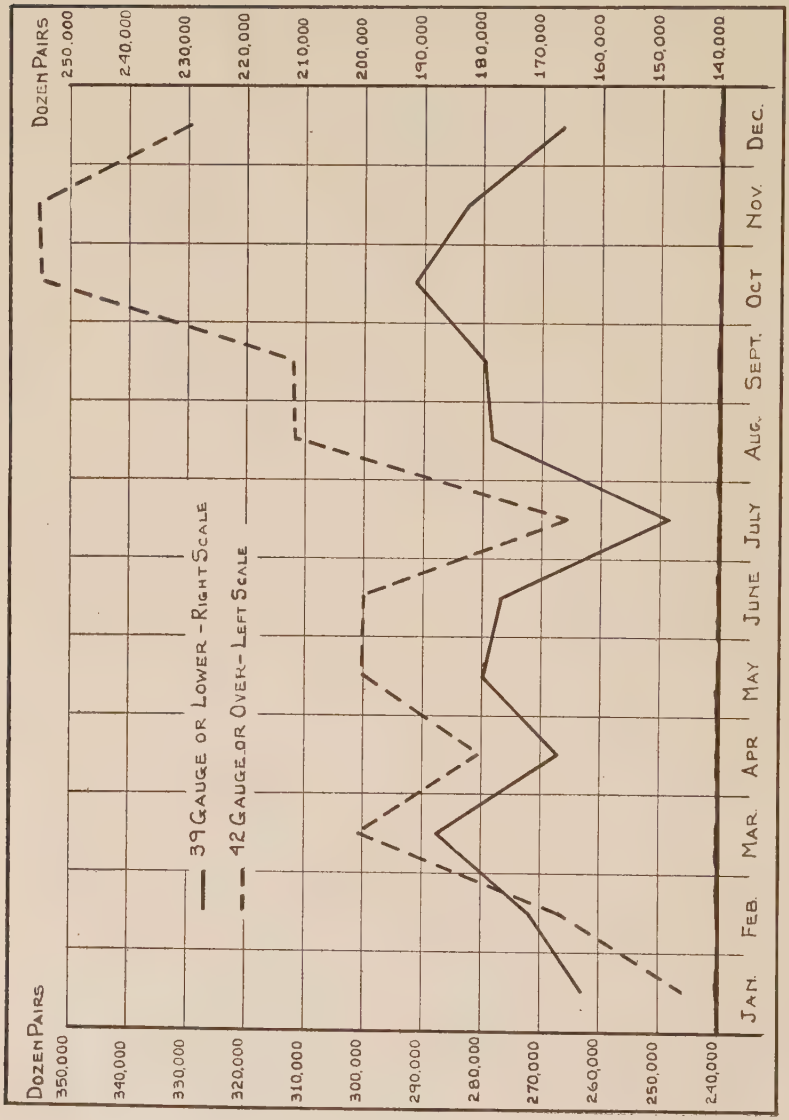


Chart VIII. Monthly Production of Full-Fashioned Hosiery Classified by Gauge, 65 Firms—1928

for both classes of product.[3] April and July declines coincide, as well as a December decrease. However, the product of 42-gauge and higher seems to be subject to a longer time trend, for its production mounts to a higher level. We have already seen that practically no 39-gauge machinery entered the industry in 1928, so that an increased level of production on higher gauges would be expected. The chart does show very vividly that, for the firms reporting, seasonality is not confined to 39-gauge hosiery. This fact would seem to imply that the management problems we have discussed are not peculiar to the production of 39-gauge hosiery. As far as seasonal production is concerned, we may even infer from the accompanying chart that the increasing output of hosiery finer than 39-gauge must mean the addition of equipment that cannot be used constantly. If seasonality is measured by the deviation of monthly productions from average production, then seasons are more marked in hosiery of gauges higher than 39. Much of the increased seasonality in the full-fashioned hosiery industry seems to be due to the influx of newer machinery of gauges finer than 39. The assertion that production problems are confined to 39-gauge stockings seems unjustified. Since the demand for the product of the lower-gauge equipment is as stable as the demand for the sheerer hosiery, or even more stable, there seems to be no reason why the mill having 39-gauge machines should consign them to the scrap pile, unless other factors make their product unprofitable. The output of 39-gauge machinery seems as well adjusted to the demand as the output of finer-gauge equipment. More definiteness could be given to this conclusion if detailed information concerning unfilled orders and stock on hand were available. Moreover, we do not know the facts of relative profits from the two classes of products. The claim is often made that 39-gauge hosiery can be sold only at a low price[4] and that

[3] Moreover, the fluctuations of production of each type of product agree with the general productivity curve shown in Chart I, page 25.

[4] Most of the $1.00 full-fashioned hosiery is made of 39-gauge fabric.

the low price results in decreased prices for the entire trade. However, such a situation would result, one would think, in an increased demand for hosiery that would decrease stock on hand and increase unfilled orders.

While scrapping any portion of the industry's equipment would better competitive conditions for the balance, there seems to be no peculiar lack of demand for 39-gauge hosiery that would lead to the need for scrapping 39-gauge machinery. Of course, it may be that this equipment should be scrapped because it is unprofitable. If the users of these machines, not knowing their costs, sell stockings at a loss, then an undesirable factor depressing all prices of hosiery is introduced. A study of the profits earned by manufacturing the two types of hosiery should be made.

From the point of view of production alone, the 39-gauge equipment, most of it 18 sections per machine, seems to be able to turn out more dozens of pairs per section hour than machines of finer gauges. It may be that this result is to be expected. On finer-gauge machines a greater number of courses per inch must be run, while these types usually have attachments, not found on the 39-gauge machine, which slow down the speed of operation.

In order to study the productivity of the different types of machines, we have isolated the questionnaire data of those firms not adding or discarding machines during 1928. We have also discarded the returns where the monthly production figures were presumably estimates. The production figures on the remaining schedules are thus the exact production of firms not changing their equipment during the year. From the monthly average of production per plant, a weekly average was secured, considering each month to be composed of four weeks. Next the total number of sections of all machines per plant was secured and multiplied by full time hours per week run by each firm, counting two shifts as double the full time hours. This computation led to a figure representing full-time section hours per week for 39-gauge and for higher-gauge equipment. By comparing

this result with the weekly output of hosiery, a figure of output per section hour (or of a section working one hour) was secured for the 39-gauge equipment of each company and for its finer-gauge machines.

Differences in output per section hour, so computed, measure two things—a variation in productivity of the two types of machines, and a variation in the ability to secure orders to operate the machines full time. Since we have already seen that the total production of each type of goods varies together, we may assume that most of the differences in output per section hour, measure differences in productive capacity.

We would not minimize the shortcomings of this method of handling production data. It is impossible to isolate the causes of the variations of output, while the "full-time section hour" basis of measurement intermingles time operated with ability to produce as causes of variation in output. In spite of these limitations, our measure affords a means of comparison between actual production from the two types of knitting machines.

A frequency table has been arranged to show the number of sections and the percentage of total sections which produce hosiery at certain rates per section hour. These data are presented in Table 27. Although the number of sections included in this classification is only about 14 per cent of all the sections now in operation, their productivity figures do give an idea of the relative efficiency of the two types of machine in producing stockings.

There is a noticeable variation in output per section hour, some sections producing less than one-half of a stocking per hour, while others produce more than one. The range is greater in 42-gauge and higher because of the inclusion of some very sheer hosiery in this group, while staple medium service weight merchandise is also included. However, while nearly 70 per cent of all sections producing 42-gauge or higher-gauge hosiery turn out less than .75 stockings per section hour, only 14.5 per cent of 39-gauge sections pro-

TABLE 27

PRODUCTIVITY OF MACHINES PER FULL-TIME SECTION HOUR

Classified by Gauge

| Stockings Produced Per Full-Time Section Hour | 39-Gauge and Lower | | | 42-Gauge and Higher | | |
|---|---|---|---|---|---|---|
| | No. of Sections | Per Cent | Cumulative Per Cent | No. of Sections | Per Cent | Cumulative Per Cent |
| under .5 | | | 0.0 | 3200 | 12.6 | 12.6 |
| .5 and under .55 | 200 | 1.7 | 1.7 | | | 12.6 |
| .55 and under .6 | | | 1.7 | 3446 | 13.6 | 26.2 |
| .6 and under .65 | 1496 | 12.8 | 14.5 | 3204 | 12.6 | 38.8 |
| .65 and under .7 | | | 14.5 | 2300 | 9.1 | 47.9 |
| .7 and under .75 | | | 14.5 | 5468 | 21.5 | 69.4 |
| .75 and under .8 | 296 | 2.5 | 17.0 | 3860 | 15.2 | 84.6 |
| .8 and under .85 | 166 | 1.4 | 18.4 | 878 | 3.5 | 88.1 |
| .85 and under .9 | 1160 | 9.9 | 28.3 | 180 | .7 | 88.8 |
| .9 and under .95 | 3534 | 30.2 | 58.5 | | | |
| .95 and under 1.0 | 2304 | 19.7 | 78.2 | 380 | 1.5 | 90.3 |
| 1.0 and over | 2538 | 21.8 | 100.0 | 2468 | 9.7 | 100.0 |
| Total | 11,694 | 100.0 | | 25,384 | 100.0 | |

duce less than this number. There is marked concentration of production of 42- and higher-gauge stockings in the groups from .55 to .75 per section hour, while most 39-gauge sections produce from .9 to over one stocking per section hour.

The differences in the productivity of these two classes of machine can best be understood by a study of Chart IX. This chart shows the percentages of all sections that produce varying numbers of stockings.

We have already expressed the idea that the increased output per section hour of 39-gauge equipment is not the result of running more nearly to capacity since the equipment depends upon almost the same seasonal fluctuations as the 42-gauge and higher equipment. Even if 39-gauge machinery operates more nearly to capacity, Chart IX shows that it turns out the stockings of which it is capable at a greater rate per section hour than higher-gauge machines turn out their brand of stockings. To be sure, finer-gauge hosiery requires more courses per inch and often has novelty features. But, from the point of view of production, the 39-gauge

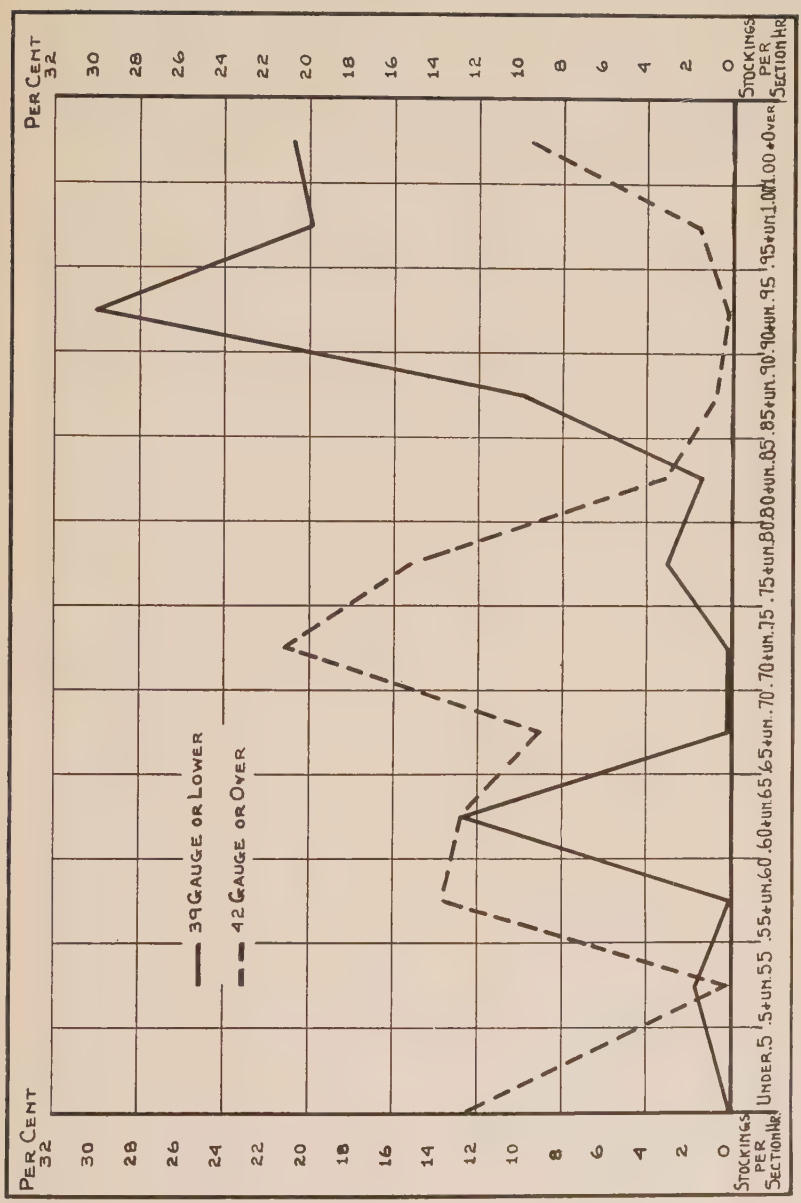


CHART IX. PERCENTAGE OF TOTAL MACHINE SECTIONS CLASSIFIED BY OUTPUT PER FULL-TIME SECTION HOUR

machine is hardly obsolete. We do need more detailed information concerning the relation of productivity to number of sections per machine. It may be that 18-section equipment most of which is 39-gauge, cannot operate as efficiently as 24-section machines. However, if machinery is becoming obsolete on this score, much of the 42-gauge machinery would also be affected.

Our discussion has led to the general conclusion that the production problems of the full-fashioned hosiery industry are not peculiar to 39-gauge hosiery. Although no more machines of this gauge are being produced, those in existence seem to be able to operate with no more seasonality than finer-gauge machines. It is possible that they are about sufficient to meet the present demand for service weight hosiery in as satisfactory a manner as the demand for other gauges is met. While 39-gauge machines are subject to no more seasonality than 42-gauge and higher, they are capable of turning out a greater output per section hour. They are efficient on the type of goods they produce. Why, then, are 39-gauge machines no longer produced? There seem to be two reasons: (1) We have seen that 42-gauge knitting machines now constitute over 50 per cent of the total machinery of the industry. These machines are versatile, being capable of knitting medium service weight hosiery as well as chiffon. It seems that hosiery manufacturers, placing new equipment orders, consider the flexibility of 42-gauge machines of real importance. They order these machines in preference to 39-gauge equipment. (2) Although 39-gauge machines are capable of producing at a high rate, their product sells at a lower price than sheerer hosiery. The question of the amount of profits made upon the products of these machines, which require more silk, seems of importance in accounting for this trend away from 39-gauge equipment.

If the 39-gauge machines are obsolete, it must be because of lack of profits available from their use. There is need of a study of the costs and profits of producing 39-gauge hosiery, and of finer hosiery. If the mill using 39-gauge

equipment is making no profits and fails to recognize the fact, then a study of costs may result in the scrapping of these machines and a relieving of the equipment pressure.

Making a study of costs is apt to prove very difficult. In the full-fashioned hosiery industry the product is not standardized, the machine capacity varies, and operation time differs between plants, so that a wide variation in output per machine is also experienced.

Data from the same mills [5] for which output per section hour was computed, have been analyzed to study the extent of variation in output per machine per year. In this case, the total yearly production was computed for each machine, the results appearing in Table 28.

TABLE 28

PRODUCTION OF FULL-FASHIONED HOSIERY PER KNITTING MACHINE IN 1928

Dozen pairs, classified by gauges

| Dozen Pairs | 39-Gauge and Lower | | | 42-Gauge and Higher | | |
|---|---|---|---|---|---|---|
| | Number of Machines | Per Cent | Cumulative Per Cent | Number of Machines | Per Cent | Cumulative Per Cent |
| Under 1500 | 199 | 26.5 | 26.5 | 254 | 22.0 | 22.0 |
| 1500–1750 | 2 | .2 | 26.7 | 197 | 17.1 | 39.1 |
| 1750–2000 | 311 | 41.5 | 68.2 | 158 | 13.7 | 52.8 |
| 2000–2250 | 154 | 20.5 | 88.7 | 55 | 4.8 | 57.6 |
| 2250–2500 | 17 | 2.3 | 91.0 | 151 | 13.1 | 70.7 |
| 2500–2750 | 14 | 1.9 | 92.9 | 136 | 11.8 | 82.5 |
| 2750–3000 | | | | 91 | 7.9 | 90.4 |
| Over 3000 | 53 | 7.1 | 100.0 | 111 | 9.6 | 100.0 |
| Total | 750 | 100.0 | | 1153 | 100.0 | |

Table 28 shows the principal production groups but fails to show what a great range in yearly output per machine actually exists in this industry. The largest output from a 42-gauge machine was 5,162 dozen pairs per year and the lowest was 1,170 dozen. With 39-gauge machines, the highest yearly output per machine was 4,566.48 dozen pairs and the lowest was 981.82.

From Table 28, it appears that output per machine has

[5] Covering 1903 machines, or about 15.2 per cent of all machines.

a tendency to fall in the higher interval classes in the case of machines higher than 39-gauge. About 58 per cent of these machines produced less than 2,250 dozen pairs of hosiery per year, while 89 per cent of the 39-gauge machines were below that level of production. Especially in the classes above 2,250 dozen pairs of production does the percentage produced by 42-gauge machinery become large.

In comparing section output, 39-gauge machinery was more productive than higher-gauge machines. Now we find that in comparing machines, the higher-gauge machines have an advantage. We have already seen that 42-gauge and higher-gauge machinery operate double shift more frequently than do 39-gauge machines.[6] This method undoubtedly accounts for much of the higher yearly production of 42-gauge equipment. However, it may be that some of the difference is caused by the smaller number of sections generally found in 39-gauge machinery. The effect of numbers of sections upon productivity should be thoroughly investigated.

Our main purpose in introducing this material has been to emphasize the lack of standard output per machine on account of the many variables of this industry. An adequate study of costs of production under such unstandard conditions, therefore, must be beyond the scope of the present study. Such an undertaking should be made in a manner that would take account of the variables of type of product, hours of work, shifts, sections per machine, number of machines per worker, attachments, type of material, labor conditions, etc. Such a study might reveal the actual obsolescence of 39-gauge, 18-section equipment because of lack of profits from merchandise made by these machines.

As far as this study is concerned, we can say that all evidence now available reveals the ability of 39-gauge equipment to continue producing. Its product is not the sole cause of the problems of the industry nor can relief from production problems be expected in the near future from

[6] See page 91.

obsolescence of 39-gauge equipment. This is true unless these machines are now obsolete because of lack of profits or unless demand swings even further to sheer hosiery in the near future, so that the present supply of 39-gauge machinery becomes superfluous for meeting a decreased demand for service weight hosiery.

A previous analysis shows that but few 39-gauge machines have been scrapped as yet.[7] However, a desire to test our conclusions more adequately, and to see if there is any evident tendency to dispose of 39-gauge equipment led to a further investigation. Through a questionnaire, we asked manufacturers to list the details of their machine disposals since 1920. Eighty-six mills or about 33 per cent of the total establishments, including over 30 per cent of the machine equipment of the industry, reported their scrappings. Only 18 mills had disposed of knitting machinery since 1920, the remainder reporting no disposals.

The type of machinery scrapped indicates almost no disposal of new machinery, practically all scrappings being of aged machines no longer mechanically profitable to operate. Table 29 lists the nature of the machinery disposed of by 18 companies since 1920.

TABLE 29

DISPOSAL OF FULL-FASHIONED HOSIERY MACHINES SINCE 1920

Reported by 18 companies

| Gauge | Sections | Number of Machines |
|---|---|---|
| 24 | 14 and 18 | 2 |
| 27 | 14 and 18 | 9 |
| 30 | 14, 18 and 20 | 10 |
| 33 | 16, 18 and 20 | 48 |
| 36 | 18 and 20 | 14 |
| 39 | 18 and 20 | 86 |
| 42 | 14 | 4 |
| 42 | 18 | 4 |
| 45 | 12 and 14 | 12 |
| 45 | 18 | 2 |
| | | 191 |

[7] See page 91.

Of all the machines represented in this table, the newest machines disposed of had been acquired in 1922. They were 45-gauge machines that were obviously experimental at the time of their building. Only 13 39-gauge machines as new as six or eight years old were scrapped, the newest of that type disposed of being six years old. The rest of the machines were ancient models, dating back as far as 1898, and including as low as 24-gauge equipment. Of the 3,200 machines operated by the reporting firms 191 or 6 per cent of the present total had been disposed of in the past eight years.

From the data at hand, we must conclude that any scrapping that has occurred has been of old worn-out equipment, with very little disposal of 39-gauge machinery on account of its lack of ability to meet style demands or to be profitable. The big influx of 39-gauge machinery between 1921 and 1923 has not yet been affected by scrappings.

However, a number of manufacturers report that they expect obsolescence of 39-gauge, 18-section equipment. In answer to the questionnaire, 18 firms expected these machines to become obsolete within the next three years. Every firm answering this question which owned both 39- and higher-gauge equipment forecast the obsolescence of the coarser-gauge machine. A few establishments even looked for obsolescence to occur in the 42-gauge group, in anticipating a future trend to even sheerer hosiery than is now worn. One firm indicated the possible obsolescence within three years of the very sheer 45-gauge machine in favor of the ultra-sheer 51. While these expressions of opinion are not actual facts, they do indicate a state of mind thinking of obsolescence of part of the industry's equipment. However, it is possible that the state of mind was induced by the question.

The purpose of the present chapter was to explain the reason for the trend away from the production of 39-gauge machinery. We must admit from evidence available that

this trend has been induced by factors other than obsolescence of this type. And we cannot at present expect much of a solution of the industry's problems through the discarding of obsolete machinery.

# CHAPTER VII

## SUMMARY AND CONCLUSIONS

The foregoing study has endeavored to bring into relief certain significant changes that have recently occurred in the full-fashioned hosiery industry, particularly quantitative and qualitative trends in production and the consequent changes in the machinery equipment of the industry. The underlying purpose has been to emphasize the changed management problems that developed with the industry and which should be entirely recognized in order to be efficiently solved.

After eliminating the production of full-fashioned half hose from the study, since no increase in the production of this article has occurred, we traced the extent of the growth of the yearly production of women's full-fashioned hosiery bi-yearly from 1919 to 1927. Figures from the bi-yearly *Census of Manufactures* were used for this purpose, and showed a growth in yearly output from an index of 100 in 1919 to 313 in 1927. At the same time, also from *Census of Manufactures* figures, we saw that the seamless industry as a group has made practically no increase in yearly production from 1919 to 1927.

In order to study monthly fluctuations in production, as well as to secure data on the production of women's seamless hosiery alone, monthly indices of the production of women's full-fashioned and seamless hosiery were computed. The data for this portion of the study were secured from the monthly *Reports of Hosiery Production, Unfilled Orders, Stock on Hand,* etc., of the Department of Commerce. This material also showed an increase in the production of full-fashioned hosiery, but revealed a decrease in the yearly production of women's seamless hosiery that led to a 1928

production of but a little over one-half of the 1925 output. Moreover, these data, placed in Chart I, revealed an increasing seasonality in the full-fashioned hosiery industry after the boom year of 1925. Especially in 1927 and 1928 did the production of full-fashioned hosiery show large monthly variations.

This portion of the study showed the extent of the development of the full-fashioned hosiery industry, its infringement on the seamless field, and the increasing seasonality that occurred with expansion.

We next tested the reasons advanced for the increasing consumption of full-fashioned hosiery and found that the per capita consumption continued to increase in 1926, 1927 and 1928, as the result of shorter skirts, the continued demand for silk and sheerness, and the vogue of colors.

In spite of the increased per capita consumption, and the continuance of very favorable demand factors, since 1925, the full-fashioned hosiery industry has shown a tendency to increase its equipment through additions or by means of a more efficient use, without a corresponding increase in the demand for hosiery. This tendency was shown, not only by noting increased seasonality, but by showing that unfilled orders decreased in 1928 to about 1¼ months' production of hosiery from 2½ times the monthly production in 1925. At the same time, stock on hand doubled from 1925 to 1928, and throughout 1928 the stock on hand was more than sufficient to meet unfilled orders. This was far from true in 1925 or 1926. From the point of view of the industry, problems of management were developing, for with increased production and decreased prices, the managerial task was becoming more difficult than under previous conditions.

To understand the equipment problem, Chapter Four was written. In it we saw that the number of mills manufacturing full-fashioned hosiery increased almost 186 per cent from 1919 to 1929. The yearly output of hosiery machinery was close to five times the 1919 output in 1925, and

three and one-half times in 1928. Moreover, on account of the trend in the production of machines of a greater number of sections, the output of equipment was even greater than the increase in the number of machines indicated. The trend in output of sections, shown by Chart III, revealed that 18-section equipment was replaced by the 20-section type about 1925, while in the last two years it appears that the 24-section machine has been gradually replacing the 20-section machine.

The relation between the increased production of number of sections and the increased production of hosiery was epitomized in Chart IV. Increased equipment and the greater use of a double-shift program for leggers have resulted in the idle equipment of the industry implied in seasonal operation, and in the use of the equipment in manufacturing to a greater extent for stock.[1]

With Chapter IV, the picture of increasing production and the accompanying problems is virtually complete. However, at this point we felt it incumbent upon us to consider the possibility that some of the equipment of the industry would become obsolete. If this were probable, then the problem of large equipment might be merely temporary, due to the present use of some antiquated machinery. Or the production problems may be localized in a certain type of product made on these obsolete machines. The style changes that caused the increased use of sheer full-fashioned hosiery suggested the possibility of the obsolescence of older equipment able to produce only service weight hosiery.

With this question in mind, data were secured from machinery manufacturers regarding their yearly output of machinery classified by gauge. Chart V showed the trend of construction of machines from 39-gauge to 42 and then toward even finer gauges. Yearly production and cumulative production of machines classified by gauges were con-

[1] Some increase in stock is of course due to the necessity of having a greater supply of hosiery to meet the demand for numerous colors, as well as to close buying by retailers. However, these changed conditions are merely evidences of a changing type of market.

sidered, as a means of showing this trend. The results were checked by a census of machines in operation during the first quarter of 1929. Both investigations showed that about one-half of all machines now in use are 42-gauge, while about one-third are 39-gauge. Close to one-fifth of all machines are both 39-gauge and 18-section, although the production of both this gauge and this number of sections has been eliminated.

It seemed that there was a real possibility of these machines' being scrapped to relieve overequipment, and even that production problems might be confined to these machines. This was the inference until a study of the output of 39-gauge and higher-gauge machinery was made in Chapter VI. From reports from about 33 per cent of all mills it was found that the production of 39-gauge hosiery was subject to the same seasonal variations that influenced 42-gauge and over. Machinery capable of meeting the demands for these two types of hosiery was equally busy in good business months and equally idle in poor months. Moreover, we found 39-gauge machines capable of producing on an average more stockings per section-hour than the other machines. From our analysis there appeared to be no reason why this equipment should be or would be scrapped, although a cost and profit study might prove the contrary.

The full-fashioned hosiery industry has undergone many revolutionary changes since the beginning of its rapid expansion in 1919. These changes have caused the evolution of new problems for the management to solve. Seasonality of operation must be coped with; it is becoming increasingly important. Moreover, the changes in style and machinery equipment that have led to keeping a greater stock of finished goods on hand, mean that the manufacturer now bears the burden of risks due to style changes. Increasing equipment combined with a hand-to-mouth buying policy have still further shifted the style risk to the manufacturer, as is shown by the lessened margin of unfilled orders in

recent years. The current buying policy, even in an industry dominated by style, should, however, afford a means of smoothing the production curve. This phase of efficient management seems to have been neglected in the full-fashioned hosiery industry.

Certainly the manufacturer of hosiery should recognize that doing business in the present buyer's market involves different responsibilities from selling goods in the earlier seller's market. The efficient manufacturer of hosiery will correlate his production with demand to prevent idle equipment and the machine builder should do likewise.

The change in the nature of the knitting equipment of the full-fashioned hosiery industry presents a problem to management. This problem varies between securing sales for the comparatively obsolete product of older machines and deciding what type of machinery to install upon expansion. It must be remembered that knitting machinery is a fixed and inflexible asset. It can be used to manufacture but a certain kind of full-fashioned hosiery. The possibility that obsolescence will render these expensive machines of less value is another risk assumed by the hosiery manufacturer since the consumer has placed increased emphasis upon style in hosiery.

The outlook for full-fashioned hosiery seems to be a still further increase in production, with style factors maintaining their importance. The manufacturer must realize that greater production probably will result in decreased prices in spite of the increased risks he is now bearing. If the industry is not to be reorganized upon a new partition of distributive shares, better management and consequent lower costs must be achieved. Such a course seems to offer a better prospect than hoping for a solution of the industry's problems through scrapping of machinery or through decreasing wage rates.

# APPENDIX A

## RELATION OF UNFILLED ORDERS AND STOCK ON HAND TO PRODUCTION OF FULL-FASHIONED HOSIERY

| Year and Month | Production in Dozen Pairs | Unfilled Orders—End of Month | Ratio of Unfilled Orders to Production* | Cancellations Dozen Pairs | Ratio of Cancellations to Unfilled Orders* | Stock on Hand—End of Month | Ratio of Stock on Hand to Production* |
|---|---|---|---|---|---|---|---|
| *1924* | | | | | | | |
| Jan. | 536,712 | 1,232,460 | 229.6 | 16,246 | 1.3 | 856,583 | 159.6 |
| Feb. | 562,172 | 1,218,261 | 216.7 | 26,369 | 2.2 | 867,623 | 154.3 |
| Mar. | 590,977 | 1,009,175 | 170.8 | 24,651 | 2.4 | 796,506 | 134.8 |
| Apr. | 601,654 | 1,360,103 | 226.1 | 22,085 | 1.6 | 781,165 | 129.8 |
| May | 619,416 | 1,187,570 | 191.7 | 21,227 | 1.8 | 765,066 | 123.5 |
| June | 539,789 | 1,065,457 | 197.4 | 44,338 | 4.2 | 795,390 | 147.4 |
| July | 475,029 | 1,036,766 | 218.3 | 43,595 | 4.2 | 874,105 | 184.0 |
| Aug. | 454,021 | 1,123,358 | 247.4 | 18,049 | 1.6 | 932,843 | 205.4 |
| Sept. | 504,092 | 1,208,320 | 239.7 | 10,619 | .9 | 823,166 | 163.3 |
| Oct. | 656,536 | 1,227,989 | 187.0 | 23,461 | 1.9 | 774,290 | 117.9 |
| Nov. | 599,224 | 1,500,110 | 250.3 | 30,806 | 2.1 | 694,174 | 115.9 |
| Dec. | 675,277 | 1,475,108 | 218.4 | 99,345 | 6.7 | 697,095 | 103.2 |
| Total | 6,814,899 | 14,644,677 | | 380,791 | | 9,658,006 | |
| Yearly Ratio | | | 214.9 | | 2.6 | | 141.7 |
| *1925* | | | | | | | |
| Jan. | 670,077 | 1,545,560 | 230.7 | 49,097 | 3.2 | 707,624 | 105.6 |
| Feb. | 690,195 | 1,521,944 | 220.5 | 18,403 | 1.2 | 720,803 | 104.4 |
| Mar. | 737,414 | 1,416,666 | 192.1 | 18,300 | 1.3 | 655,587 | 88.9 |
| Apr. | 768,074 | 1,877,370 | 244.4 | 26,860 | 1.4 | 626,352 | 81.6 |
| May | 761,828 | 2,162,783 | 283.9 | 18,691 | .9 | 628,351 | 82.5 |
| June | 810,738 | 2,423,710 | 299.0 | 48,144 | 2.0 | 690,014 | 85.1 |
| July | 817,655 | 2,237,124 | 273.6 | 30,381 | 1.4 | 705,242 | 86.3 |
| Aug. | 822,793 | 2,010,062 | 244.3 | 46,543 | 2.3 | 748,093 | 90.9 |
| Sept. | 833,252 | 1,874,313 | 224.9 | 28,980 | 1.6 | 750,904 | 90.1 |
| Oct. | 947,608 | 2,433,266 | 256.8 | 38,576 | 1.6 | 737,738 | 77.9 |
| Nov. | 844,567 | 2,370,077 | 280.6 | 37,963 | 1.6 | 695,409 | 82.3 |
| Dec. | 904,453 | 2,010,860 | 222.3 | 111,607 | 5.6 | 694,745 | 76.8 |
| Total | 9,608,654 | 23,883,735 | | 473,545 | | 8,360,862 | |
| Yearly Ratio | | | 248.6 | | 2.0 | | 87.0 |
| *1926* | | | | | | | |
| Jan. | 868,769 | 2,146,035 | 247.0 | 57,443 | 2.7 | 781,971 | 90.0 |
| Feb. | 906,491 | 2,043,114 | 225.4 | 44,964 | 2.2 | 795,314 | 87.7 |
| Mar. | 1,075,111 | 2,370,126 | 220.5 | 45,987 | 1.9 | 823,374 | 76.6 |
| Apr. | 1,021,162 | 2,469,103 | 241.8 | 34,406 | 1.4 | 829,614 | 81.2 |
| May | 1,000,787 | 2,496,998 | 249.5 | 36,577 | 1.5 | 866,956 | 86.6 |
| June | 1,055,962 | 2,558,879 | 242.3 | 88,431 | 3.5 | 932,982 | 88.3 |
| Total and Average | | | | | | 5,030,211 | 84.9 |
| July | 943,493 | 2,423,427 | 256.9 | 36,264 | 1.5 | 1,078,432 | 114.3 |
| Aug. | 1,039,217 | 2,131,917 | 205.2 | 136,012 | 6.4 | 1,185,641 | 114.1 |
| Sept. | 1,061,350 | 1,998,144 | 188.3 | 30,443 | 1.5 | 1,245,451 | 117.4 |
| Oct. | 1,151,736 | 2,348,101 | 203.9 | 57,149 | 2.4 | 1,350,142 | 117.2 |
| Nov. | 1,114,764 | 2,339,606 | 209.9 | 55,966 | 2.4 | 1,322,865 | 118.7 |
| Dec. | 1,126,986 | 2,177,544 | 193.2 | 246,086 | 11.3 | 1,365,455 | 121.2 |
| Total | 12,365,828 | 27,502,994 | | 869,728 | | 7,547,986 | |
| Yearly Ratio | | | 222.4 | | 3.2 | | 117.2 |

* Relative of each month based on 100.

| Year and Month | Production in Dozen Pairs | Unfilled Orders—End of Month | Ratio of Unfilled Orders to Production* | Cancellations Dozen Pairs | Ratio of Cancellations to Unfilled Orders* | Stock on Hand—End of Month | Ratio of Stock on Hand to Production* |
|---|---|---|---|---|---|---|---|
| *1927* | | | | | | | |
| Jan. | 1,113,611 | 2,110,507 | 189.5 | 57,987 | 2.8 | 1,564,787 | 140.5 |
| Feb. | 1,125,429 | 1,980,147 | 176.0 | 56,476 | 2.9 | 1,681,683 | 149.4 |
| Mar. | 1,325,386 | 1,867,096 | 140.9 | 51,632 | 2.8 | 1,699,874 | 128.3 |
| Apr. | 1,221,441 | 1,899,697 | 155.5 | 44,993 | 2.4 | 2,032,390 | 166.4 |
| May | 1,218,458 | 1,888,971 | 155.0 | 64,581 | 3.4 | 2,086,930 | 171.3 |
| June | 1,329,568 | 1,896,447 | 142.6 | 41,220 | 2.1 | 2,179,833 | 164.0 |
| July | 988,414 | 1,744,200 | 176.5 | 35,182 | 2.0 | 2,175,944 | 220.1 |
| Aug. | 1,241,470 | 1,724,141 | 138.9 | 21,235 | 1.2 | 2,270,623 | 182.9 |
| Sept. | 1,284,996 | 1,974,251 | 153.6 | 65,467 | 3.3 | 2,272,763 | 176.9 |
| Oct. | 1,351,837 | 2,061,920 | 152.5 | 46,042 | 2.2 | 2,182,440 | 161.4 |
| Nov. | 1,393,699 | 2,262,854 | 162.4 | 89,773 | 4.0 | 2,067,835 | 148.4 |
| Dec. | 1,313,730 | 2,151,513 | 163.8 | 176,040 | 8.2 | 2,176,994 | 165.7 |
| Total | 14,908,039 | 23,561,744 | | 740,628 | | 24,392,096 | |
| Yearly Ratio | | | 158.0 | | 3.1 | | 163.6 |
| *1928* | | | | | | | |
| Jan. | 1,367,246 | 2,315,726 | 169.4 | 62,843 | 2.7 | 2,378,543 | 174.0 |
| Feb. | 1,401,999 | 2,260,144 | 161.2 | 30,169 | 1.3 | 2,575,852 | 183.7 |
| Mar. | 1,549,064 | 1,910,012 | 123.3 | 64,795 | 3.4 | 2,506,763 | 161.8 |
| Apr. | 1,448,193 | 1,774,206 | 122.5 | 61,511 | 3.5 | 2,632,080 | 181.8 |
| May | 1,541,705 | 1,791,160 | 116.2 | 51,236 | 2.9 | 2,697,840 | 175.0 |
| June | 1,474,470 | 1,888,108 | 128.1 | 59,446 | 3.2 | 2,854,709 | 193.6 |
| July | 1,167,663 | 1,749,886 | 149.9 | 23,335 | 1.3 | 2,805,572 | 240.3 |
| Aug. | 1,510,395 | 1,533,092 | 101.5 | 22,377 | 1.5 | 2,935,346 | 194.3 |
| Sept. | 1,384,455 | 1,503,676 | 108.6 | 64,232 | 4.3 | 2,857,325 | 206.4 |
| Oct. | 1,733,629 | 1,590,809 | 91.8 | 38,070 | 2.4 | 2,792,493 | 161.1 |
| Nov. | 1,709,376 | 2,150,258 | 125.8 | 55,039 | 2.6 | 2,612,388 | 152.8 |
| Dec. | 1,515,422 | 2,215,208 | 146.2 | 85,886 | 3.9 | 2,468,895 | 162.9 |
| Total | 17,803,617 | 22,682,285 | | 618,939 | | 32,117,806 | |
| Yearly Ratio | | | 127.4 | | 2.7 | | 180.4 |
| *1929* | | | | | | | |
| Jan. | 1,725,278 | 2,229,582 | 129.2 | 29,548 | 1.3 | 2,738,999 | 158.8 |
| Feb. | 1,670,270 | 1,923,112 | 115.1 | 36,206 | 1.9 | 2,866,137 | 171.6 |
| Mar. | 1,793,171 | 1,697,393 | 94.7 | 76,687 | 4.5 | 2,852,386 | 159.1 |
| Apr. | 1,772,253 | 1,761,428 | 99.4 | 96,436 | 5.5 | 2,872,012 | 162.1 |
| May | 1,859,660 | 1,948,587 | 104.8 | 51,003 | 2.6 | 2,973,005 | 159.9 |
| June | 1,659,504 | 1,889,674 | 113.9 | 65,295 | 3.5 | 2,928,552 | 176.5 |

* Relative of each month based on 100.

# APPENDIX B

## TYPES OF HOSIERY AND METHODS OF MANUFACTURE

The principal types of hosiery, according to method of manufacture and means of shaping the product, are seamless, full-fashioned, and an inferior grade termed "cut" hosiery. This latter type is cut out, as a seamstress cuts a dress from a pattern, from a specially-knitted web or from portions of material spoiled in manufacturing other products. Such salvaging is the principal reason for the manufacture of this type of hosiery, which forms a very insignificant percentage of the local production.

Seamless hosiery is knit, without seams, on a circular machine. The needle bed is circular, its product being a knitted tube that must only be seamed at heel and toe in order to complete the stocking. Although tension devices are used to narrow seamless hosiery at the ankle, these stockings have, like the needle bed on which they were knit, a constant diameter. Any shape that they have is accomplished by the boarding process, when the hosiery is placed, while damp, upon leg-shaped boards and heated. The form thus given the stocking lacks lasting qualities, especially after several washings.

Full-fashioned hosiery, on the other hand, is knitted to the shape of the leg. Its diameter varies so that it insures a permanently shaped stocking. Such hosiery is knitted flat, selvaged ready for seaming, and shaped by the addition or dropping of stitches where required. The needle bar on the knitting machine is straight. "To narrow the fabric, the loop carried by one needle is transferred [by automatic machine action] to the needle next it toward the center. . . . This is done simultaneously on each side of the stocking, so that the finished article will show, along either side . . . what appear to be larger stitches," [1] but which are caused by placing two loops upon one needle.

Two machines are required in the manufacture of full-fashioned hosiery, a legger and a footer to knit the two principal parts of the stocking. The use of two machines in manufacture is necessary because of the great differences in length, width and number of narrowing operations in the leg and in the foot.[2] The legger knits the stocking from the top to the widest part of the ankle. The fabric is then transferred to the

[1] United States Tariff Commission, Tariff Information Surveys I-6 Cotton Knit Goods, page 7.

[2] Combination leggers and footers have been manufactured, but they cannot operate rapidly and are, as yet, not commercially practical. While machinery manufacturers are attempting to erect a practical combination machine, the consummation of their work appears to be many years distant.

footer by girl operators, called toppers or transfer bar toppers, who place each loop of the leg portion on a needle of the footer which can then complete the knitting of the stocking. The stocking as it comes from the footer is flat, fashioned to the shape of the leg, so that it is necessary only to join the two edges to complete the stocking. At the heel and toe, the joining is accomplished by the looping process in which the two edges are fitted together, loop by loop, over a revolving disc that joins them by a very flat seam. The joining of the remaining portions is done by seaming on a sewing machine that results in a perceptible ridge.

Each knitting machine has numerous sections. Each section is actually a knitting machine working in synchronism with the other sections, which have in common the drive motion, and the operation of supplementary attachments and mechanisms such as narrowing motion, thread tension, yarn feeding, etc. Stockings are knitted simultaneously, one to a section. Usually the legger section is fourteen inches wide and the footer section ten inches. The legger is usually constructed of 18, 20 or 24 sections, while the footer may have as many as 28 or even 30 sections.

Since it takes about three times as long to knit the leg as to knit the foot, a balance of production may be secured by operating three leggers to one footer. The exact ratio, however, depends upon the type of hosiery being produced and the number of sections in each machine.

The fineness of hosiery is determined by the number of needles used. Obviously, 30 needles per inch, making 30 loops per inch, will knit a finer fabric than a machine having 26 needles per inch. The number of needles on full-fashioned hosiery machines is indicated by the term "gauge," the gauge number representing the number of needles per inch and a half on the needle bar.[3] For instance, a 39-gauge machine would have 39 needles on every 1½ inches of the needle bar or 26 needles to the inch. The fineness of the stocking is also signified by gauge, or number of loops per inch and a half, corresponding, of course, to the machine on which it was knitted. A horizontal row of these loops in the stocking is termed a "course," while a vertical row is called a "wale."

As the gauge becomes finer, that is, as more needles per inch are used, the use of finer silk becomes necessary. The fineness of the silk is determined by the number of strands of silk twisted together in the preliminary winding process. On a 39-gauge machine, it is possible to use from 6- to 12-thread silk. The resultant product will be closely woven and comparatively heavy, being termed a medium service weight or a service weight stocking. Chiffon hosiery, on the other hand, is made of 2-, 3- or 4-strand silk. It is light in weight and cannot be satisfactorily knit on 39-gauge machines because the needles are not close enough to knit a firm fabric. The silk is too fine to fill up the space between the needles. Some mills, however, are making a five-strand

[3] The standard of measurement is thought to have developed from the make-up of one of the earlier knitting frames. For that machine, the needles were cast into lead bases, two needles in each three inch mold. Now, the needles are placed individually in the needle bar and can be individually replaced; however, the old gauge designation is retained.

stocking on 39-gauge machines that is being sold as chiffon. It is maintained that a 42-gauge machine can knit either medium chiffons or medium service weights and that it is, therefore, the most flexible knitting machine. However, for very fine chiffon hosiery, machines with gauges as fine as 57 and 60 have been developed by foreign machinery producers. They knit two-strand silk [4] that has been degummed and dyed before knitting. The usual procedure is to knit the stockings in the gray and to dye the finished stocking by dipping into the dye vats. The very sheer hosiery, however, could not be subjected to this strain on the fabric so that the silk is dyed before knitting. The stocking made of this silk is termed "ingrain."

While the seamless stocking has the advantage of comfort in its lack of seams, except at the heel and toe, the better appearance of the full-fashioned product has more than counterbalanced any possible discomfort of this type. The well-dressed woman in the United States seems to have been thoroughly "sold" on the necessity of wearing full-fashioned hosiery. The seamless manufacturers have found it imperative to the sale of their product to add a mock seam to their stockings to simulate fashioned hosiery markings.[5] For the same reason, many have also added mock "crow's feet" or narrowing marks to make the similarity more striking. Such hosiery is often called "mock fashioned" or "fashion marked."

### Full-Fashioned Hosiery Machinery Production

"The full-fashioned machine is probably the most delicate and complicated piece of mechanism now in use in any type of industrial establishment. The machine has 50,000 parts and all of them must be in perfect order or the stockings will have a defect and will lack the proper appearance." [6] Moreover, each unit of four machines involves an investment of from $25,000 to $30,000 so that full-fashioned hosiery mills are not readily started. We must remember, in talking of the machine equipment of this industry, that full-fashioned knitting machines cannot be rapidly scrapped without a large loss. Although changes in style are shifting the demand from service weight to chiffon hosiery, we must bear in mind that machinery involving such heavy investments will not be quickly scrapped. If obsolescence occurs, it involves large losses. Moreover, the production of these machines is so slow that the industry cannot quickly change the composition of its equipment by quickly buying new types of machines. There are comparatively few producers of full-fashioned knitting machines.

It was not until 1898 that the first full-fashioned machine was produced in the United States,[7] and while some of these machines, of English

[4] It is claimed that some one-strand stockings have been knit.

[5] In recent months, seamless hosiery has been produced without the mock seam. The stockingless idea is being capitalized to sell seamless hosiery colored to match the skin so that bareness will be simulated.

[6] Geiges, Gustave, "Waste Elimination in the Full-Fashioned Hosiery Industry," *Bulletin of the Taylor Society*, June 1927, Vol. XII, No. 3, page 411.

[7] Department of Commerce, Miscellaneous Series No. 31, *The Hosiery Industry*, page 176.

origin, were in use here before that time, they provided a negligible portion of the country's total hosiery production.

Imports of machines from the Chemnitz district of Germany, supplemented by a small number of domestic manufacture, increased the production of full-fashioned hosiery in the early part of the twentieth century. However, fashioned hosiery failed to become a sizeable factor in a market that was supplied largely by the seamless product of circular machines. At this early date, cotton was the principal raw material of which hosiery was knit. The domestic production of full-fashioned knitting machines increased rapidly after 1914, since it was entirely free from German competition from 1914 to 1920.

The Textile Machine Works of Reading is the leading domestic producer of full-fashioned knitting machines, having as its only American competitor the Wildman Manufacturing Co. of Norristown, Pa. This latter company began the manufacture of full-fashioned knitting machines in 1926, when it took over the business of the Richter Machine Company of Philadelphia, which had operated since 1895 on a small scale. The new Wildman machine embodies numerous innovations, the most significant being a thirty-section footer.[8] While the Textile Machine Works has also recently introduced a new short needle, hence a higher-speed machine, there have been no revolutionary improvements in machine design since the first use of the modern machine.

The leading importer of full-fashioned knitting machines is the Alfred Hofmann Co., Inc., of West New York, N. J., which imports the HSL (Theodor Lieberknecht), for which a speed of 66 courses per minute is claimed on a 42- or 45-gauge machine. This company's other machines are termed the Schubert and Salzer, and H. Alban Ludwig, both fine-gauge equipment.

A second importer, the Grosser Knitting Machine Company, handles the Hilscher Duo-type, which is a fine-gauge, high-speed machine. Comparatively few Hilschers are in operation in the United States, although the German manufacturers export to a large extent to the continental countries of Europe.

The Karl Lieberknecht machine is used to a considerable degree in the United States. It is imported by Louis Hirsch, Inc., of New York, and like other imported machines is high-speed and fine-gauge. This company until recent months also imported the Einseidel machine, a development of an older Boessnecht knitting machine. Lately, however, the Einseidel importations have been undertaken by a new company, Dr. Robert Reiner, Inc., of Weehawken, N. J.

The only other imported machine is the David Richter. Practically none of these machines have entered the United States during the past four years.

[8] Another innovation is the use of a slow drive motor that aims to eliminate the heavy lifting of knitting. In at least one factory, women have been trained to operate these machines.

We have listed the sources of knitting machinery entering the full-fashioned hosiery industry because a considerable portion of the preceding study has dealt with the growth of the equipment as compared with the growth of production of hosiery. It is, of course, to the interest of the manufacturer of full-fashioned hosiery machinery to be concerned with an orderly growth of the industry. He desires a constant demand for his product, and is vitally interested in the possibility that obsolescence will make some of the industry's equipment replaceable.

# BIBLIOGRAPHY

## BOOKS, PAMPHLETS AND MONOGRAPHS


American Federation of Full-Fashioned Hosiery Workers. Proceedings of Seventeenth Annual Convention. Philadelphia. 1928.

Bragdon, Lord, Nagle & Co. American Directory of the Knitting Trade. Yearly. New York. 1922 to 1928.

Committee on Elimination of Waste in Industry of the Federal Engineering Society. Waste in Industry. Washington. 1921.

Chamberlain and Quilter. Knitted Fabrics. Leicester, England. 1911.

Charlotte Industrial Bureau. Survey of Cost of Producing Full-Fashioned Hosiery. Charlotte. 1928.

Davison Publishing Co. Davison's Knit Goods Trade. Yearly. New York. 1918 to 1928.

Davis, William. Hosiery Manufacture. New York. 1923.

Dooley, William H. Textiles. New York. 1924.

Drabill, Albert. Knitting Industry in the United States. Transactions of the National Association of Cotton Manufacturers. Vol. 71.

Egerton, K. A. H., and Flake, Wilson. The British Market for Hosiery. United States Department of Commerce. Bureau of Foreign and Domestic Commerce. Trade Information Bulletin No. 495. June 1927.

Federal Council of the Churches of Christ in America. Industrial Relations in a Hosiery Mill. Information Service. Vol. 7. No. 20. Saturday, May 19, 1928.

Fred, T. Walter. The Story of a Pair of Silk Stockings. Chattanooga, Tennessee. 1923.

Geiges, Gustave. Overdevelopment in Textiles, with special reference to the full-fashioned hosiery industry. Philadelphia. 1928.

Kester, Roy B. Accounting, Theory and Practice. 2 vols. New York. 1922.

Kier, Malcolm. Manufacturing Industries in America. New York. 1928.

Kneeland, Natalie. Hosiery, Knit Underwear and Gloves. Chicago. 1927.

Lipson, E. Increased Production. London. 1928.

Makem, John A. Trade Up Hosiery Values, and The Full-Fashioned Hosiery Institute. Boston. 1928.

Massachusetts Minimum Wage Commission. Bulletin No. 10. Wages of Women in Hosiery and Knit Goods Factories in Massachusetts. Boston. 1916.

Mazur, Paul. American Prosperity—Its Causes and Consequences. New York. 1928.

National Association of Hosiery and Underwear Manufacturers. Proceedings of Annual Convention. 1917 to 1928.

Person, H. S. Scientific Management Since Taylor. New York. 1924.

Pitman, Isaac. Artificial Silk. London. 1927.

Scott Company, The. Report of a survey of Industrial Relations, including Recommendations Regarding the Labor Policy in the Mills of the Full-Fashioned Hosiery Manufacturers' Association of Philadelphia. Philadelphia. 1919.

Shubert und Salzer Maschinenfabrick. Wirkmaschinen für regulär gearbeitete Strumpfwaren. Chemnitz in Sachsen. 1924.

Silk Association of America. Annual Trade Division Reports on Knit Goods and Hosiery. 1919 to 1927.

Textile Machine Works. The Future of the Full-Fashioned Hosiery Industry. Reading. 1922.

Tompkins. The Science of Knitting. New York. 1914.

Tugwell, Rexford G. Industry's Coming of Age. New York. 1928.

Woodruff, Ruth J. The Hosiery Industry. Philadelphia. 1925.

United States Department of Commerce, Bureau of the Census.

Census of Manufactures. Knit Goods. 1919.

Biennial Census of Manufactures. Knit Goods. 1921.

Biennial Census of Manufactures. Knit Goods. 1923.

Biennial Census of Manufactures. Knit Goods. 1925.

Biennial Census of Manufactures. Hosiery. 1927. (Preliminary Report)

Monthly Reports of Hosiery Production, Orders and Stock. Feb. 1923 to Apr. 1929.

United States Department of Commerce. Bureau of Foreign and Domestic Commerce.

Miscellaneous Series. No. 31. The Hosiery Industry. Washington. 1915.

Foreign Commerce and Navigation of the United States for the Calendar Year 1928. Washington. 1928.

United States Department of Commerce.

Commerce Yearbook 1928. (sixth number) 2 vols. Washington. 1928.

Statistical Abstract of the United States 1928. (fiftieth number) Washington. 1928.

United States Department of Labor. Bureau of Labor Statistics.

Bulletin No. 328. Wages and Hours of Labor in the Hosiery and Underwear Industries—1922. Washington. 1923.

Bulletin No. 452. Wages and Hours of Labor in the Hosiery and Underwear Industries, 1907 to 1926. Washington. 1927.

United States Tariff Commission.

Tariff Information Survey. I-6. Cotton Knit Goods. Washington. 1922.

Tariff Information Survey. C-29. Machinery. Washington. 1921.

## PERIODICALS

American Directory of the Knitting Trade. Yearly. Bragdon, Lord, Nagle & Co. New York.

*American Wool and Cotton Reporter.* Weekly. Frank P. Bennett & Co. Boston, Mass.

*Cotton.* Monthly. W. R. C. Smith Publishing Co. Atlanta, Georgia.

Davison's Knit Goods Trade. Yearly. Davison Publishing Co. New York.

*Hosiery Retailer, The.* Monthly. The Hosiery Retailer. Boston, Mass.

*Hosiery Worker, The.* Bi-weekly. American Federation of Full-Fashioned Hosiery Workers. Philadelphia, Pa.

*International Knit Goods News.* Monthly. Department of Commerce. Bureau of Foreign and Domestic Commerce. Washington, D. C.

*Knit Goods Bulletin.* Monthly. Hosiery and Underwear Manufacturers Association. New York.

*Knitting Mill News, The.* Monthly. Knitting Mill News and Knitting Trades Service Bureau, Inc. Philadelphia, Pa.

*Textile World.* Weekly. Bragdon, Lord & Nagle Co., Inc. New York.

*Underwear & Hosiery Review, The.* Monthly. The Knit Goods Publishing Corporation. New York.

*Women's Wear Daily.* Daily. Fairchild News Service. New York.

## BIBLIOGRAPHIES

Knit Goods Manufacturers of America. References on the Knit Goods Industry. Utica. New York. 1920.

United States Department of Commerce. Bureau of Foreign and Domestic Commerce. Government Publications Relating to Textiles. (Revised Edition.) Washington. 1928.

# INDEX


Cancellations:
—— relation to unfilled orders, 43, 47
Census of knitting machines, 58–59, 88–89
Consumption, per capita, 37–42, 51–52

Double-machine system, 74
Double shift, 70–74

Equipment (see footers, leggers and knitting machines)

Footers, 71–72, 92–95
Full-fashioned hosiery:
—— competition with seamless, 14–15, 40, 50
—— demand for, 26–28, 32, 36–37
—— exports of, 30, 39, 51
—— imports of, 31
—— material used in, 1, 13, 27, 30, 34–36, 42
—— methods of manufacture, 121–122
—— per capita consumption of, 37–42, 51–52
Full-fashioned hosiery, production of:
—— compared to equipment production, 60–62, 68–70
—— compared to other industries, 13–16
—— monthly, 17–20, 100–108
—— rates of increase in, 20–21, 28, 31
—— seasonality of, 2, 20–21, 24–29, 42–43, 61, 70, 101–104
—— surplus, 26, 32
—— value of, 13, 42, 50–51
—— yearly, 1, 10–12
Full-fashioned hosiery industry:
—— definition of, 5–6
—— future prospects of, 49–50, 52
—— growth of, 9
—— localization of, 6
—— overequipment in the, 43, 47, 68–76
—— productive capacity of, 43, 49

Gauge:
—— machines in operation classified by, 90–91, 95–97
—— machine production classified by, 79–80, 82, 85, 88

Hand-to-mouth buying:
—— effect on seasonality, 3–4
—— relation to style, 3

Imports:
—— full-fashioned hosiery, 30–31
—— knitting machines, 59–60

Knitting machines:
—— census of, 88–99
—— gauge of, 90–91, 95–97
—— leggers and footers, 72, 91–95
—— length of life of, 59
—— nature of, 5–6, 11
—— obsolescense of, 54, 100, 111–113
—— production and importation of, 58–61, 123–125
——— related to hosiery production, 60–62
—— productivity of, 75, 100–113
—— scrapping of, 111
—— sections of, 92–97
—— style and, 52
—— trend in gauges of, 78–91
—— trend in sections of, 92–97

Leggers, 92–95

Management:
—— efficiency in, 1, 49, 75–76
—— problems of, 2, 4, 8, 33
Men's hosiery production, 10
—— machinery used in, 11
Mills, hosiery, 54–58

Per capita consumption of hosiery, 37–42, 51–52
Philadelphia mills, 55–56

Reading mills, 57–58

Seamless hosiery:
—— competition with full-fashioned, 14–15, 40, 50
—— exports of, 39–40
—— monthly production of, 15–16
—— per capita consumption of, 40–41
—— seasonality of production of, 24–29
—— value of production of, 15–16, 50–51
—— yearly production of, 15–16, 24
Seasonality in production, 2–3, 62, 75–77 (see also full-fashioned hosiery and seamless hosiery)
Section hour, production per, 104–106

Sections, knitting machine:
—— per machine, 64, 66
—— production of, 62–66, 68–70
———— trend in, 66–68
—— type in use, 92–98
Shifts, number of:
—— ratio of leggers to footers, 71–73, 91, 95
—— relation to production, 73
Stock on hand, 3–4, 43, 46–47, 49
Style:
—— relation to equipment, 52, 87
Style—(*Continued*)
—— relation to production, 27–29, 36–37, 41, 51, 86, 98–99

Types of hosiery, 124–126

Unfilled orders, 43
—— relation to production, 43, 45–46
Union, full-fashioned hosiery, 7–8, 73–74

Women's hosiery (see full-fashioned hosiery)

OCT 25 '36
SEP 19 1940